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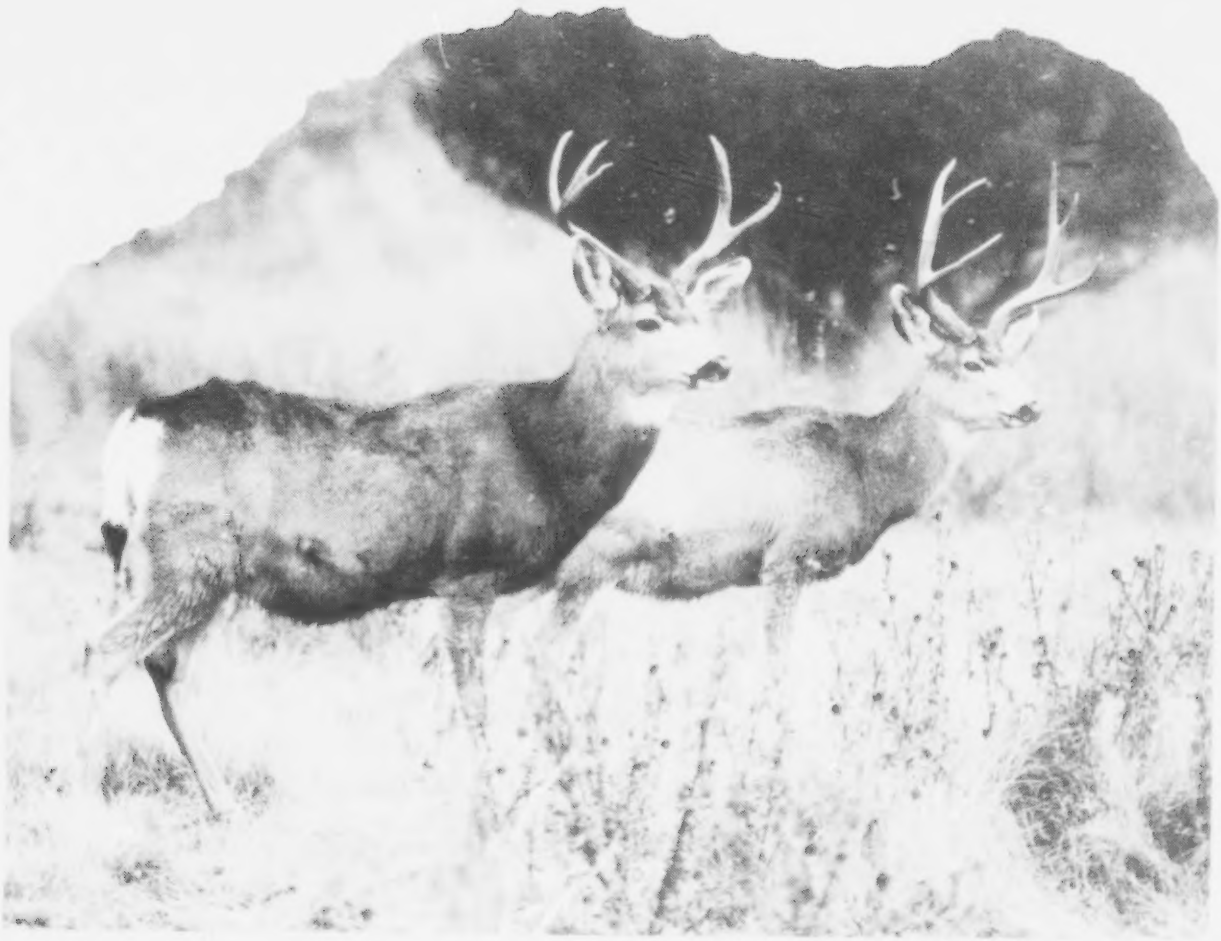
United States
Department of
Agriculture

Forest
Service

Southwestern
Region

July 1986

Draft Environmental Impact Statement, Proposed Kaibab National Forest Plan



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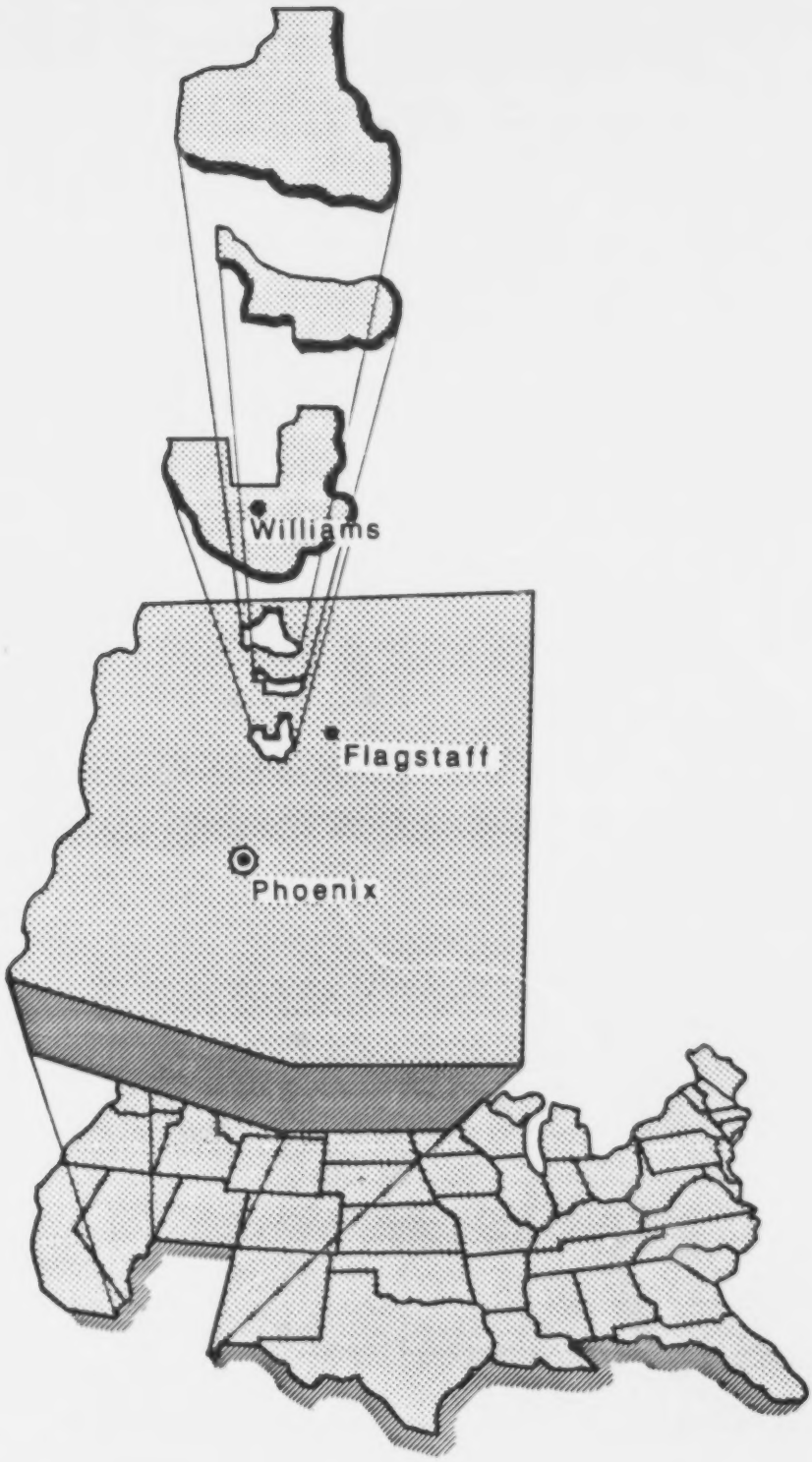

Draft Environmental Impact Statement

Proposed Kaibab National Forest Land and Resource Management Plan
Coconino, Yavapai and Mohave Counties

Type of Action	Administrative
Lead Agency	USDA, Forest Service
Responsible Official	Sotero Muniz, Regional Forester
For Further Information	L. A. Lindquist, Forest Supervisor Kaibab National Forest 800 South Sixth Street Williams, AZ 86046 (602) 635-2681

Abstract

A proposed action and five alternatives for a land and resource management plan (Forest Plan) for the 1,534,443 acres Kaibab National Forest are described and compared. The proposed action (PA) and alternatives are:

PA Designed to respond to major issues and management concerns with a mix of both market and non-market management emphases.

A Management is designed to provide resource production assigned to the Forest in the Regional Guide.

B Projects current resource management and production consistent with current budget levels.

C Emphasizes a non-commodity mix of management practices while providing at least the minimum production and protection of resources.

D Emphasizes a commodity-producing management practices while protecting, and enhancing the affected area.

E Maximizes net public benefits regardless of management emphasis, given the goal of protection of the affected environments and a budget ceiling.

The PA constitutes the Forest Service preferred alternative. The Forest Plan, when approved, will guide management of the Forest and will ordinarily be revised on a ten year cycle, or not more than fifteen years.

Comments should be sent to the Forest Supervisor, Kaibab National Forest. Comments must be received in the Forest Supervisor's office not later than close of business (4:30 o'clock, pm), _____.

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Table of Contents

1. PURPOSE OF AND NEED FOR ACTION 1

Overview 1
Objectives 1
Planning Process 1
Public Issues 2
Reader's Guide 4
Planning Regulations 9
. 10

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION 13

Overview 13
Regulatory Requirements 13
Alternatives Development Process 13
Alternatives Considered but Eliminated from Detailed Study 14
Alternatives Considered in Detail 17
Comparison of Alternatives 19
Economic Factors 30
Summary of Significant Effects of Alternatives 50
Adverse Environmental Effects Which Cannot be Avoided 63
. 65

3. AFFECTED ENVIRONMENT 67

Overview 67
Physical and Biological Setting 67
Social and Economic Setting 68
Resource Elements 70
Developed Recreation 70
Dispersed Recreation 72
Wilderness 74
Visual Resources 76
Cultural Resources 77
Wildlife and Fish 77
Lands 85
Natural Areas 90
Range 90
Timber and Fuelwood 92
Insects and Diseases 96
Soil and Water 97
Minerals 100
Air Quality 103
Fire Management 103
Facilities and Corridors 104
Transportation System 104
Administrative Facilities 106
Energy. 106

4. ENVIRONMENTAL CONSEQUENCES 107
Overview . . . . . 107.
Resource Considerations 108
Recreation 108
Wilderness 119
Visual Resources 121
Cultural Resources 122
Wildlife and Fish 124
Lands 131
Natural Areas 134
Range 134
Timber 137
Fuelwood 144
Water Yield 145
Minerals 149
Fire Protection 152
Integrated Pest Management 153

Air Quality 154
Facilities 154
Irretrievable Commitments 157
Economic & Social Considerations 158
Adverse Environmental Effects Which Cannot Be Avoided 160
Summary of Significant Effects 162

5. LIST OF PREPARERS 165

6. CONSULTATION WITH OTHERS 167

GLOSSARY 171

BIBLIOGRAPHY 195

APPENDIX A - PUBLIC INVOLVEMENT 203

APPENDIX B - DESCRIPTION OF ANALYSIS PROCESS 213

APPENDIX C - LIST OF TECHNICAL REPORTS 225

INDEX 227

List of Tables

Table	Title	Page
1	Summary of Commercial Timber Management Characteristics by Alternative	31
2	Ranking of Timber Issue Resolution by Alternative	32
3	Summary of Fuelwood Output by Alternative	33
4	Ranking of Fuelwood Issue Resolution by Alternative	33
5	Summary of Range Management Characteristics by Alternative.	34
6	Ranking of Range Issue Resolution by Alternative.	34
7	Percent Changes from Current Average Soil Loss and Unsatisfactory Watershed Condition Acreage in Period 5	35
8	Ranking of Watershed Condition Issue Resolution by Alternative.	35
9	Summary of Developed Recreation Management Characteristics by Alternative	36
10	Ranking of Recreation Issue Resolution by Alternative	36
11	Ranking of Alpine Skiing Issue Resolution by Alternative.	37
12	Summary of Dispersed Recreation Management Characteristics by Alternative	38
13	Ranking of Dispersed Recreation Issue Resolution by Alternative	38
14	Average Annual Transportation Management Characteristics by Alternative in Period 1	39
15	Ranking of Transportation Issue Resolution by Alternative	40
16	Changes in Habitat Capability for Indicator Species; Projections through Period 5 by Alternative	40
17	Ranking of Wildlife Habitat Issue Resolution by Alternative	41
18	Summary of Cultural Resource Management Characteristics by Alternative	41
19	Ranking of Cultural Resources Issue Resolution by Alternative	42
20	Average Annual Wilderness Management Funding (M$) by Alternative.	43
21	Ranking of Wilderness Management Issue by Alternative	43
22	Summary of Lands Management Program Characteristics by Alternative.	44
23	Ranking of Lands Issus Resolution by Alternative.	45
24	Allocation and Degree of Mineral Restrictions by Alternative.	45
25	Additional Acres of Mineral Withdrawals by Alternative.	46
26	Ranking of Minerals Management Issue Resolution by Alternative.	46
27	Issue Resolution Ranking Summary.	47
28	Acreage Available for Commodity Uses by Alternative	48
29	Average Annual Outputs by Alternatives and Selected Benchmarks by Resource Elements	48-50
30	Average Annual Maintenance and Investment Costs by Alternatives and Selected Benchmarks	50-51
31	Average Annual Cost by Resource Element-Thousand Jan. 1, 1982 Dollars	52-54
32	Average Annual Benefits-Thousand Jan. 1, 1982 Dollars	54-56
33	Comparison of Receipts, Costs, and Net Cash Flows by Alternative and Maximum PNV for Decades 1 and 5	57
34	Economic Comparisons by Alternative and Maximum PNV for Resource Element	58
35	Value Analysis by Alternative-Millions Jan. 1, 1982 Dollars	59
36	Comparison of Alternatives with Max PNV Assigned Benchmark by Alternative and Max PNV	60
37	Average Annual Irretrievable Resource Commitment in the First Decade by Alternative	63
38	Population Trends for Areas Influencing the Kaibab National Forest.	69
39	Capacity and Use of Existing Major Developed Recreation Sites	70
40	Developed Recreation Use Projections in MRVD's.	71
41	Trail Inventory	72
42	Existing ORV Closures	73
43	Current Acreage and Annual Recreation Use in RVD's by ROS Setting	73
44	Dispersed Recreation Use Projections in RVD's	74
45	Wilderness Areas by WOS Setting	75
46	Average Annual Current, Projected Use and Potential Wilderness Capacity in RVD's	75
47	Acres by Visual Quality Objective	76
48	Number of Total Species/Game Species by Class	78
49	Major Vegetation Types.	78

50 1984 Big Game Populations 80
51 Big Game Harvests nd Population Levels for 1984 80
52 Estimated Existing Old Growth Acres by Vegetation Type. 81
53 Animal Species That Are Listed, Candidates, or Managed as Sensitive by the Forest Service 82
54 Plant Species That Are Listed, Candidates, or Managed as Sensitive by the Forest Service 83
55 Lands Desirable for Acquisition 86
56 Potential L&WCF Acquisitions. 87
57 Existing Rights-of-Way Needs. 87
58 Miles of Major Utility Corridors by Ranger District 88
59 Location and Type of Electronic Sites 88
60 Existing Withdrawals. 89
61 Acres by Capacity Class for Each Vegetation Type at Present 90
62 Area of Full Capacity Acres by Management Intensity. 91
63 Land Classification 92
64 Acres by Condition Class, Total Suitable Forest 93
65 Past Sawtimber and Roundwood Production 94
66 Total Past Fuelwood Production, Commercial and Personal Use 95
67 Existing Water Impoundments and Consumptive Use for the Kaibab National Forest Within the Verde, Little Colorado, and Colorado Watersheds 98
68 Table of Watershed Condition with Priority for Improvement Work 99
69 Inactive Mined Areas with Environmental Degredation 100
70 Mineral Status. 101
71 Active Mines. 101
72 Acres of Possible Mineral Occurrence 102
73 Average Annual Fires and Burned Area by Fuel Type, 1970-1979. 104
74 Road Miles by Maintenance Level 105
75 Current Maintenance Responsibilities. 105
76 Average Annual Developed Recreation Outputs in RVD's by Alternative 108
77 Recreation Investment Schedule by Alternative 109-110
78 Additional Site Capacity in PAOT's From Recreation Expansion and Construction Projects by Alternative. 110-111
79 Management Intensity of Public Sector Recreation Sites by Alternative 112
80 Developed Recreation Economic Indicators by Alternative 112-113
81 Irretrievable Developed Recreation Commitments by Alternative for Planning Period 1 114
82 Average Annual Dispersed Outputs in RVD's by ROS Classification 115
83 Average Annual Dispersed Recreation Operation and Maintenance Budget for Planning Period 1 by Alternative. 115
84 Proportion of Total Forest Area Managed at Standard and Less Than Standard Service Levels by Alternative. 116
85 Dispersed Recreation Investment Schedule by Alternative 116-117
86 Average Annual Dispersed Investment Costs by Alternative. 118
87 Acres Closed to Off Road Vehicle Use by Alternative 118
88 Irretrievable Dispersed Recreation Commitments by Alternative for Planning Period 1 118
89 Average Annual Wilderness Management Funding by Alternative 119
90 Average Annual Wilderness Use in RVD's by Alternative 120
91 Allocation and Level of Visual Resource Constraints by Alternative. 122
92 Average Annual Acres of Treatment Requiring Cultural Resource Survey by Alternative. 123
93 Average Annual Financing for Program Administration, Non-Project Survey and Site Evaluation by Alternative. 124
94 Habitat Improvement Acres by Alternative for First Planning Period. 125
95 Diversity Index Values for Planning Periods 1 and 5 by Alternative. 126
96 Change in Diversity Index Values for Planning Periods 1 and 5 by Alternative 126
97 Changes in Habitat Quality From Habitat Improvement by Alternative. 127
98 Changes in Habitat Capability for Indicator Species in Planning Period by Alternative. 127
99 Changes in Existing Wildlife Cover in Planning Period 5 by Alternative 128
100 Change in Habitat Capability for Primary and Secondary Cavity Nesters in Planning Period 5 by Alternative 128
101 Changes in Old Growth Habitat in Planning Period 5 by Alternative 129
102 Attainment of Arizona's Comprehensive Plan Objectives 129
103 Impact of Alternatives on the Existing Supply of Wildlife Recreation. 130
104 Increased Habitat Availablity Based on Miles of Road Obliteration by Alternative 130
105 Irretrievable Loss of Wildlife Recreation Opportunity in MWFUD's. 131

106 Average Annual Lands Program Budget for Planning Period 1 by Alternative 132
107 Average Annual Special Land Use Receipts for Planning Period 1 by Alternative 133
108 Range Capacity by Alternative 135
109 Full Capacity Range Management Prescription 135
110 Replacement of Structural Improvements 136
111 Pinyon-Juniper Vegetative Type Maintained as Grassland 136
112 Irretrievable Loss of Range Capacity in First Decade (M aum's). 137
113 Suitable Acres Allocated to Timber Harvest by Alternative 137
114 Annual LTSYC Compared to Achievement of 90 Percent of Potential Growth in the Fifth Decade by Alternative. 138
115 10-Year Irretrievable Merchantable Volume Commitment in MMCF Decade One by Alternative. 139
116 Age Class Distribution at Decade 20 in M Acres (Suit. & Unsuit.). 139
117 Site Preparation-Acres Per Decade for Decades 1-5 by Alternative. 140
118 Precommercial Thinning Acres Per Decade for Decades 1-5 141
119 Commercial Thinning Acres Per Decade for Decades 1-5. 141
120 Seed Cut Acres Per Decade by Alternative. 142
121 Final Removal Acres Per Decade by Alternative 142
122 Estimated Old Growth Acres by Vegetation Type 143
123 Acres Allocated to Extended Rotations by Alternative. 143
124 Total Fuelwood Harvest Planning Period 1 144-145
125 10-Year Irretrievable Green Pinyon-Juniper Fuelwood Commitment (MMBF) 145
126 Average Annual Water Yield - M Acre Feet. 145
127 Watershed Improvement Acres for Planning Periods 1-5. 147
128 Road Obliteration Acres for Planning Periods 1-5. 147
129 Watershed Maintenance Acres for Planning Periods 1-5. 147
130 Change from Existing Unsatisfactory Watershed Condition by Alternative. 148
131 Change from Present Soil Loss by Alternative. 148
132 Average Annual Minerals Mangement Program Funding and Projected Mineral Outputs for Planning Period 1 by Alternative. 149
133 Additional Acres of Mineral Withdrawals by Alternatives 150
134 Allocation and Degree of Mineral Restrictions by Alternative. 151
135 Annual Acres of Fuel Treatment with Fire Management Funds 152
136 Summary of Average Annual Protection Costs, Losses, and Burned Area by Alternative. 152
137 Estimated Area Burned by Wildland Fires Annually in M Acres 154
138 Average Annual Miles of Road Reconstruction and Construction by Alternative 155
139 Total Miles of Forest Development Roads by Alternative. 155
140 Average Road Maintenance Funding in M$ per Planning Period. 156
141 Average FA&O Construction and Reconstruction Financing in M$ per Decade by Alternative. 157
142 Average FA&O Maintenance Financing in M$ per Decade by Alternative. 157
143 Average Annual Irretrievable Resource Commitments in the First Planning Period by Alternative 158
144 Summary of Alternatives by Employment, Income, & Population in Decade 1 160
145 Resources Data Sources. 215
146 List of Level 2 Identifiers 217
147 Stand Condition Classes 218
148 Stand Condition Class Codes 218
149 Listing of AA for Forest Planning 218
150 Description of the Management Emphasis. 223
151 Relationship of Management Practices to Managment Emphasis (Coordinated Allocation Choice). 223
152 Williams/Chalender Zone/AA Relationship 225
153 Tusayan Zone/AA Relationship. 226
154 North Kaibab Zone/AA Relationship 227
155 Minimum Management Requirements 228
156 Output/Environmental Effect 229-231
157 Benefit Values for Outputs. 231-232
158 Activty Code Index. 232-233
159 Objective Functions Used in Benchmarks and Alternatives 235
160 Timber Legal and Policy Constraints Used in Benchmarks and Alternatives. 235
161 Other Commonly Used Constraints 236
162 Average Annual Output by Benchmark and Planning Alternative 237-242
163 Comparison of Cumulative Economic Benefits, Costs, and Present Net Value of Benchmarks and Planning Alternatives to Maximum PNV Assigned

164 Benchmark (thousands of 1982 First Quarter Dollars) 243
Comparison of Average Annual Outputs Having Market Prices with Outputs Having Assigned Values for Max PNV Assigned and Max PNV Market Benchmarks. 244
165 Acreage Allocation by Management Emphasis for Selected Benchmarks in 1000 acres 245
166 Fuelwood Cut-off's 247
167 Constraints Common to Each Planning Problem. 248

PLANNING RECORD

The Environmental Impact Statment and Kaibab National Forest Land and Resource Management Plan document the analysis and decisions resulting from the planning process.

The detailed documentation of the analysis, assumptions, and decisions are recorded in an extensive file and library referred to in the EIS and Forest Plan as the planning record.

The planning record contains the date, computer results, references, direction, and decisions that supported and drove the process. The planning record is often cited for further information on various subjects.

Appendix C of the EIS lists the technical reports that summarize, in detail, the phases of the planning process. The technical reports are incorporated by reference for purposes of analysis in the EIS and Forest Plan. The technical reports are available in the planning record.

The planning record is a public record. It is available for review during the hours of 8:00 a.m. to 4:30 p.m., Monday through Friday. Specific documents and general information from the planning record are available by writing:

Kaibab National Forest
Land Management Planning
800 South 6th Street
Williams, AZ 86046

Commercial Telephone: (602) 635-2681

A charge may be made to cover costs of such things as photo-copying, searching for information, and computer time.

1. Purpose of and Need for Action

OVERVIEW

This Environmental Impact Statement (EIS) describes a Proposed Action (Preferred Alternative) and alternatives for management of the land and resources of the Kaibab National Forest for the next ten to fifteen years. The Proposed Action is the Forest Plan. Each alternative provides a different way to address local, regional, and national issues; provides for using and protecting resources; and fulfills legislative requirements.

Every alternative generated a different mix of goods and services from the Forest. Each alternative was evaluated to determine its potential to provide a sustained yield of goods and services in a way that maximizes long-term public benefits in an environmentally sound manner.

Alternatives were evaluated as to how well they provided net public benefits. "Net public benefits" is an overall expression of the benefit to the nation of outputs and positive effects, less associated costs and negative effects, whether they can be quantitatively valued or not. Net public benefits are measured by several quantitative and qualitative criteria rather than by a single measure or index.

The Proposed Action is the alternative that, in the opinion of the Forest Service, provides for a level of goods and services that maximizes long-term net public benefits and is the Forest Service preferred alternative.

The EIS describes the affected environment, discloses the significant environmental consequences, and responds to the issues associated with implementing the Proposed Action and the Alternatives. An EIS is required by the implementing regulations for the National Forest Management Act (NFMA) in Title 36 of the Code of Federal Regulations (CFR) Part 219. The EIS is prepared in the format recommended in the Council on Environmental Quality (CEQ) Regulations in Title 40 of the CFR, Parts 1500-1508.

The Proposed Action is the Forest's Land and Resource Management Plan (Forest Plan), which is a separate document. Preparation of the Forest Plan is required by the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended by the National Forest Management Act (NFMA) of 1976. For purposes of National Environmental Policy Act (NEPA) disclosure, the EIS and Forest Plan are treated as combined documents [40 CFR 1506.4].

A Notice of Intent to prepare an EIS for the Forest Plan was published in the Federal Register on June 30, 1983. The EIS and Plan are being circulated for review and comment. After the close of the comment period, the Forest Plan and EIS will be revised as necessary and the revised EIS will be used by the egional Forester in making a final decision on approval of the plan. The revised EIS and Plan will be filed with the Environmental Protection Agency, and made available to the public as a Final EIS. This decision will be documented in a Record of Decision that will also be available to the public.

OBJECTIVES

The objective of developing the Forest Plan is to provide for multiple use and a sustained yield of goods and services from the Kaibab National Forest at a high level of long term net public benefit and in an environmentally sound manner [36 CFR 219.1(a)]. The Forest Plan is intended to accomplish these objectives by:

Determining public issues, management concerns and resource use and development opportunities;

Defining management practices appropriate to the range of conditions found on the Kaibab National Forest;

Choosing the combination of practices which fits the relative productivity and sensitivity of different kinds of lands found on the Forest, and which best meet the needs expressed by the public issues;

Specifying the resource production outputs and schedules expected under each specific land area management prescription;

Establishing standards and guidelines for resource use and protection;

Providing a framework for designing individual projects and making budget proposals;

Integrating individual resource planning activities and decisions;

Coordinating Forest Service planning activities with the efforts of other federal agencies, state and local governments and Indian tribes; and,

Providing information for use in subsequent RPA Programs and Regional Guides.

The Forest Plan is designed to guide the management of the Forest until a new plan is prepared. Ordinarily a new plan will be prepared on a ten year cycle, or at least every fifteen years in accordance with 36 CFR 219.10(f) and (g). When a new Forest Plan is prepared, all aspects will be reevaluated based on improved information, monitoring results, and new issues identified.

The planning horizon used for estimating outputs and effects was 200 years, however, the displays in the EIS usually show data only for early parts of the planning horizon, usually the first fifty years. While long-range effects have been estimated, the Forest Plan is only valid for ten to fifteen years until a new plan is prepared, and needed changes in direction will occur as they are identified through the amendment or replanning process.

The Forest Plan either supersedes or incorporates all previous resource and land use plans, including interim plans and direction issued for this Forest. Following approval of the Plan, all future permits, contracts, and other instruments for the use and occupancy of the Kaibab National Forest will be consistent with this Plan. In addition, all administrative activities, including budget proposals, will be consistent with the Plan [36 CFR 219.10(e)].

The Forest Plan and Environmental Impact Statement (EIS) will guide all subsequent projects on the Kaibab National Forest, and the EIS will be used for tiering of project proposals [40 CFR 1508.28]. Tiering means that, if needed, future environmental documents for projects based on the Plan will summarize or incorporate by reference the issues discussed in this EIS. Environmental documents for those projects will focus on site-specific issues unique to the project.

Environmental assessments will not be undertaken for projects that, based on past experience and environmental analysis, have been shown not to have significant environmental effects, individually or cumulatively to the human environment [40 CFR 1508.14].

The plan will be implemented by way of various site specific projects and activities authorized by actual approved budgets, which may or may not conform exactly to the Forest Plan. If there is a significant change to the budget or to legal direction to the Forest Service, the Plan may have to be amended to conform. It is important to note that all the proposals in the plan <u>can</u> be accomplished from a physical, biological, economic and legal perspective, but it is not certain that they <u>will</u> be accomplished within the time frame proposed. For example, the allowable sale quantity is the maximum regulated volume of timber that <u>can</u> be sold over the planning period, not the volume that <u>must</u> be sold.

PLANNING PROCESS

National and Regional Planning

Forest planning occurs within the overall framework of both national and regional planning. The National RPA Program sets policy, standards, guidelines, and resource production objectives in response to identified national issues. The RPA Program also assigns national production objectives (RPA targets) to each Forest Service Region. A Regional Guide establishes management standards and guidelines, addresses regional issues and responds to the National Program by distributing RPA Program targets to the individual National Forests. The Southwestern Regional Guide of August 1983 provides this direction for the Forest.

The planning process is a continuously repeating process in that the information from the Forest level flows up to the national level, is incorporated in the RPA Program, and then flows back to the Forest level. The RPA Program and Regional Guide are updated every five years.

Forest Planning Process

The planning process specified in NFMA regulations [36 CFR 219.12] was followed in developing the Forest Plan. The planning process followed an interdisciplinary (ID) approach. An ID team was formed of professionals with diverse backgrounds in the physical, biological, economic, and social sciences. The ID team approach is intended to assure that the knowledge and perceptions of different specialists are brought together into a common management plan.

The NFMA planning process is described in 36 CFR 219.12, and consists of the following actions:

Identifying the purpose and need
Developing planning criteria
Collecting inventory data and information
Analyzing the management situation
Formulating alternatives
Estimating effects of alternatives
Evaluating alternatives
Recommending the preferred alternative (Proposed Action)
Approving and implementing the Forest Plan
Monitoring and evaluating actions under the Forest Plan

The implementing regulations require that a number of analyses be done during the planning process that are not displayed in the Forest Plan. Examples of process requirements are identifying lands not suited for timber production, determining suitability and potential capability for forage production, estimating probable occurrence of minerals and potential for future mineral development, and providing an overview of cultural resources.

The EIS and Forest Plan are not intended to contain all of the documentation for process requirements. Complete documentation is contained in the planning records. For example, the Analysis of the Management Situation (AMS) report documents most of the planning process requirements specified in 36 CFR 219.13 through 219.28. Appendix B contains a summary of the analytical process used to prepare the Plan. Appendix D contains a list of technical reports documenting various process actions.

Planning Records

The documents and files that chronicle the Forest planning process are available for inspection at the Forest Supervisor's Office during regular business hours. The planning records contain detailed information and criteria used in developing the Plan as required in 36 CFR 219.10(h). Planning records are incorporated by reference at appropriate points in the text and appendices of this EIS and in the Forest Plan.

Coordination of Planning

Planning for management of the Forest is coordinated with other land managers and private landowners. Coordination is a continuous process following the planning effort described in the EIS and Plan.

There are 43,450 acres of private land within the Forest boundary. Notification of private landowners was attempted through a mailing to landowners identified through a search of the county property and tax records. As a result of these efforts, some of the landowners became involved in the planning process.

Indian reservations are located immediately adjacent to or within close proximity to the Forest. Bordering reservations include Navajo and the Havasupai. Nearby groups include the Hopi, Kaibab Paiute, Yavapai and Hualapai. These Native American groups were notified during the initial public involvement programs. Follow-up letters were sent requesting any comments they might have regarding the planning effort, and inviting them to participate.

Contact was made with tribal officials through correspondence and meetings. In addition, the Forest Service contracted a study to develop Navajo concerns for the planning process. The report of this process is incorporated in the scoping materials. Further efforts to involve these people will be made during the public review period for the EIS and Plan. Forest personnel were unable to identify any formal planning documents which when implemented, would have an impact on the Forest, or would be impacted by the Kaibab National Forest Plan.

Specific concerns expressed by Tribal officials and by individuals have been incorporated as part of the issue statements listed under "Public Issues".

Numerous federal, state, county, and local agencies in the area were contacted during the initial public involvement phase and coordination has continued since that time. In addition, on-going informal consultation has continued during the planning process with representatives of various special interest groups and with private individuals who are interested in the planning process. Appendix A includes a complete list of agencies, tribes and organizations contacted.

Planning for the Beale Wagon Historic Study Trail has been coordinated between the Kaibab and Coconino National Forests. The Kaibab Plan studies, recommends and specifies the trail corridor designation and management for the entire 61 mile route from Campbell Crater to Eagle Nest Mountain. The Kaibab and Coconino National Forests provide maintenance of signs and protection of the corridor on those portions of the trail within their boundaries.

Planning Area

The Kaibab National Forest is comprised of three separate parcels located in the northern [Arizona Strip] and north central area of Arizona. Communities near or adjacent to the Forest are: Fredonia, Jacob Lake, Tusayan, Grand Canyon Village, Parks, Williams, and Ashfork. The closest larger city is Flagstaff. The Forest contains 1,600,075 gross acres, of which 43,450 are in other ownerships. In addition, the Kaibab is managing 1,510 acres of Kendrick Mountain Wilderness that lies within the Coconino National Forest while the Coconino is managing 7,125 acres of the Sycamore Canyon Wilderness that lies within the Kaibab. Also, 16,557 acres of the Kaibab are managed by the Navajo Army Depot. The net result is 1,534,443 acres which is the acreage used throughout this DEIS and the Forest Plan.

There are four ranger districts: the Williams Ranger District, the Chalender Ranger District, the North Kaibab Ranger District, and the Tusayan Ranger District. The Forest lies principally in Coconino County, with smaller areas within Yavapai and Mohave Counties.

Within the the National Forest, there is one designated National Game Preserve [Grand Canyon National Game Preserve], and all or part of four designated Wilderness Areas [Sycamore Canyon, Kanab Creek, Kendrick and Saddle Mountains].

PUBLIC ISSUES

Issues Development

These problem statements are the public issues, management concerns, and resource use and development opportunities for the Kaibab National Forest. They are the fruit of the public involvement, scoping, and comment analysis process. These are termed "issues" and establish the nature and scope of the planning process and this EIS [40 CFR 1501.7 and 1508.25]. Forest resource planning develops alternative solutions to these problem statements. The analysis used during the planning process measures how well each alternative resolves the problems expressed by these issue statements. The particular alternative chosen as a result of the planning process should satisfactorily resolve these issues as efficiently as possible. Appendix A of this document contains a detailed description of the process followed for developing these statements.

Issues

The following public issues, management concerns and resource use and development opportunities were approved by the Regional Forester on October 13, 1983 for use in land and resource management planning for the Kaibab National Forest. These issue statements are not listed in any priority order.

1. Commercial Timber

Provide for a sustained level of timber outputs to support local dependent industries. Increase yields through intensive reforestation, timber stand improvement, thinning and harvesting practices to improve stand stocking and to eliminate age class imbalances and reduce insect and disease problems. However, other competing Forest values, such as wildlife habitats, visual resources, soil and watershed maintenance, and concern for the safety and welfare of Forest visitors can delay or reduce increases of timber yields, and reduce financial returns to the federal and local governments.

The results of certain silvicultural practices, (timber stand improvement cuttings, site preparation, and reforestation) and harvesting methods, (commercial thinning, clearcutting, and shelterwood cutting) concern many people who fear (1) depletion of growing stock, (2) erosion and declining soil productivity, and (3) impacts on watershed condition, visual resources, forage production, and wildlife habitats. Opportunities exist for improving the design and application of silvicultural activities and logging practices, and for improving the diversity and arrangement of timber stands in terms of stand size, species composition, age composition, tree sizes, and stocking levels and patterns.

2. Fuelwood

Demand for fuelwood continues to increase; however total use and availability are not well measured. Some preferred fuelwood sources, such as pine snags, oak, and alligator juniper are considered to be in short supply and there is a potential to damage resources if overcutting takes place. Significant amounts of ponderosa pine logging slash and similar residues are produced in harvesting and cultural operations and must be treated for disposal. Increased substitution of these materials for preferred sources of fuelwood may improve economic efficiency and forest protection.

3. Range

Provide for sustained level of grazing in support of local ranches. Although significant progress has been made toward bringing permitted grazing in line with grazing capacity, in some areas recovery of unsatisfactory rangeland is slow because of degraded soil and vegetative conditions and the lack of structural range improvements needed to manage livestock use. Range management activities and rangeland improvement activities may impact wildlife habitats, watershed conditions, visual resources, and contribute to soil erosion and declining soil productivity. Opportunities exist for (1) more intensive range management regimes, (2) rangeland improvement through public and private investments, (3) adjustments of grazing use in line with grazing capacity, and (4) the management of a wild burro territory.

4. Watershed

Many watersheds have significant acreages in unsatisfactory condition with declining soil productivity because of such factors as oxidation of soil organic matter, lack of vegetative cover, compaction, soil crusting, and erosion. Soil and watershed maintenance and improvement practices have the potential to impact wildlife habitats, visual resources, and yields of other resource outputs; however, opportunities exist for direct watershed and soil resource improvements.

5. Developed Recreation

Some existing recreation developments are deteriorating because of overuse or age, eventually resulting in loss of capacity and uneconomic sites. Opportunities exist for reversing this trend, and for increasing developed site capacity through expansion of existing sites and construction of new recreation sites through public and private sector investments.

6. Downhill Skiing

Significant public interest exists for the development of alpine skiing facilities. An opportunity for a ski area exists on Bill Williams Mountain. Capture of this opportunity may impact wildlife habitats, visual resources, watershed condition, Indian religious shrines, and the yield of other resource outputs.

7. Dispersed Recreation

There are opportunities for meeting increased demand for dispersed recreation through the development of hiking trails, horseback riding support facilities, cross-country ski trails, off-road vehicle areas, interpretive sites and materials, scenic view points, and dispersed water developments. Dispersed recreation use and management practices may impact wildlife habitats and reduce yields of other resource outputs.

Lands suitable for primitive, semi-primitive nonmotorized and semi-primitive motorized recreation opportunities are limited in area and distribution in this National Forest. There are opportunities for both increasing the amount and improving the distribution of lands suited for these particular recreation opportunities. However, changes to the existing spectrum or recreation opportunities may affect the yield of other resource outputs.

Off-road use can adversely impact particular areas with important and sensitive wildlife, visual resources, and soil and watershed values. Opportunities exist for control of off-road vehicle activities where these resource values are adversely affected.

8. Transportation System

There is significant public interest regarding the design standards, location, density, maintenance standards, and cost of both permanent and temporary roads. In addition the public has expressed concern regarding restricting access to Forest lands and the resources thereof. There is also public recognition that unrestricted access to National Forest lands has sometimes resulted in damage to the road system, vandalism to other facilities, and adverse impacts to visual, soil, watershed, and wildlife resources.

There are continuing requests for providing commercial air services between the northern portion of the Kaibab National Forest and nearby air terminals. Commercial air services may impact visual, soil and water, and wildlife values, safety and welfare of Forest visitors, and result in noise and air degradation. In addition, these kinds of services may be incompatible with the management emphasis and resource management direction for the neighboring North Rim area of Grand Canyon National Park and thereby adversely affect national park programs.

9. Wildlife Habitat

In some areas, past activities such as timber harvest, snag removal, overgrazing, and road construction have degraded wildlife habitats. Opportunities exist for direct wildlife habitat improvements to restore and provide for quality habitats in many areas of the Forest. Wildlife habitat improvements have the potential to impact soil and watershed, timber, visual, and range resources. There is a need to clarify the status and management direction for the Grand Canyon Game Preserve.

10. Cultural Resources

Cultural resource management for this National Forest is a narrowly defined program generally limited to site avoidance. In spite of increased efforts to protect and identify cultural resource sites, there are continuing losses of cultural resources from vandalism and accidental destruction. There is a backlog of inventoried cultural resource sites to be evaluated for final disposition, i.e.nomination to the National Register, continuing protection, salvage, etc. Until these evaluations are completed, blanket protection of all sites is necessary.

A portion of the historic Beale Wagon Road is situated within this National Forest. The National Trails System Act, as amended, requires evaluation of this route as a National Historic Trail. A recommendation for the administrative action regarding designation of the Beale Wagon Road as a National Historic Trail is necessary. Designation may affect the yield of other resource outputs. The Kaibab has been designated as lead forest for the trail evaluation.

11. Wilderness and Special Areas

The Arizona Wilderness Act of 1984 established three wilderness areas in this National Forest. Management direction is necessary to guide the use and management of these areas to protect and maintain their wilderness character and value.

The opportunity exists to establish an Arizona Fescue Research Natural Area. Allocation of land for this purpose may reduce or eliminate the yield of other resource outputs from that area. Evaluation of the opportunity to establish this special area, and a recommendation for administrative action is necessary.

Many administrative problems, such as road access, utility rights-of-way, and property encroachment, occur on National Forest lands that are adjacent to other ownerships. This situation is most concentrated in the vicinity of the established communities of Williams and Tusayan. Opportunities exist to adjust the pattern of National Forest land in the vicinity of these communities in order to allow economic growth and improve National Forest administration.

12. Land Ownership Adjustment

Many administrative problems, such as road access, utility rights-of-way, and property encroachment occur on National Forest lands that are adjacent to other ownerships. This situation is most concentrated in the vicinity of the communities of Williams and Tusayan. Opportunities exist to adjust the pattern of National Forest land to allow economic growth and improve National Forest administration.

13. Minerals Management

Mineral activities sometimes conflict with other resource values and uses. There is a need to (1) ensure access for mineral development and (2) provide adequate protection of special resource values which could be affected by mining activity. Mineral withdrawals and surface use and occupancy restrictions can prevent or reduce resource conflicts associated with mineral exploration and development activities.

Oil and gas lease recommendations, including any surface use stipulations, must be made for pending and future lease applications.

Criteria for Evaluation

Some measure is needed to compare alternatives for resolving each of the above issues, and to evaluate environmental impacts. The following criteria were selected for each of the issues. The comparison of alternatives, described in Chapter 2, and the environmental consequences, described in Chapter 4, use these criteria.

Criteria for Evaluating Resolution of Issue 1:

1. Annual sale on a sustained basis of not less than 55,300 MBF of sawtimber and pulpwood to support local dependent industries (North Kaibab 45,300 MBF; south side of the Kaibab 10,000 MBF).
2. Improvement in stand stocking and age class distribution.
3. Suitable timberland.
4. Stand size.
5. Species composition.
6. Stand stocking level.
7. Stand diversity and distribution.
8. Dwarf mistletoe infection level.
9. Watershed condition.
10. Wildlife habitats.
11. Soil loss.
12. Visual resource quality objectives.
13. Forage production.

Criteria for Evaluating Resolution of Issue 2:

1. Inventory preferred fuelwood availability and use.
2. Balance fuelwood removals with availability.
3. Increase substitution of pine slash for preferred fuelwood sources.
4. Wildfire fuel loading.

Criteria for Evaluating Resolution of Issue 3:

1. Intensity of range allotment management.
2. Range forage improvements.
3. Range structural improvements.
4. Watershed condition.
5. Soil loss.
6. Wildlife habitats.

Criteria for Evaluating Resolution of Issue 4:

1. Soil resource improvements.
2. Water resource improvements.
3. Soil loss.
4. Watershed condition.
5. Range allotment management practices.
6. Road density and maintenance.

Criteria for Evaluating Resolution of Issue 5:

1. Maintenance of existing developed site facilities.
2. Increasing capacity of existing sites.
3. New developed sites through public and private sector investment.
4. Developed site use maintained in balance with capacity.

Criteria for Evaluating Resolution of Issue 6:

Issue 6 is being evaluated outside the Forest planning process as a separate decision. A separate environmental impact statement has been prepared.

Criteria for Evaluating Resolution of Issue 7:

1. Dispersed recreation facilities.
2. Amount and distribution of recreation opportunities in each ROS Class.
3. Visual resource quality objectives.
4. Road density and road maintenance standards.
5. Area closed to off-road vehicle use.

Criteria for Evaluating Resolution of Issue 8:

1. Design, density, location, and maintenance standards for all roads.
2. Aircraft service to North Rim area.
3. Soil loss.
4. Visual resource quality objectives.
5. Safety and welfare of forest users.
6. Noise and air quality degradation.
7. Compatibility with Grand Canyon National Park resource objectives.

Criteria for Evaluating Resolution of Issue 9:

1. Wildlife and fisheries use.
2. Direct habitat improvements in degraded habitats.
3. Watershed condition.
4. Range allotment management practices.
5. Stand stocking levels.
6. Stand size and distribution of successional stages.
7. Suitable timberland.
8. Road density and maintenance standards.

Criteria for Evaluating Resolution of Issue 10:

1. Disposition of cultural resource sites.
2. Survey of non-project related area.
3. Preparation of a cultural resource overview document.

Criteria for Evaluating Resolution of Issue 11:

1. Protection and maintenance of Wilderness character and values.

Criteria for Evaluating Resolution of Issue 12:

1. Improved management of National Forest land as a result of land exchange.

Criteria for Evaluating Resolution of Issue 13:

1. Acres of proposed mineral withdrawals.
2. Surface use restrictions for other land uses, and sensitive soils.

READER'S GUIDE — This Reader's Guide is provided to assist the reader in understanding what information is presented in subsequent chapters of the EIS.

Chapter 2 — Alternatives Including the Proposed Action. Chapter 2 is based on information and analysis presented in Chapter 3 and Chapter 4. It describes the alternatives considered, presents the environmental impacts of the Forest Plan alternative compared to other alternatives, assesses issues resolution, and provides a basis for choice among the alternatives.

Chapter 3	Affected Environment. Chapter 3 describes the environment of the area affected by the alternatives including the physical and biological setting, the socioeconomic setting, and the current resource situation.
Chapter 4	Environmental Consequences. Chapter 4 discloses the environmental impacts of alternatives, any adverse environmental effects that cannot be avoided should the alternatives be implemented, the relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources that would result from the alternatives.
Chapter 5	List of Preparers. Chapter 5 lists people who were primarily responsible for preparing the EIS, Forest Plan, or significant background papers or other work.
Chapter 6	Consultation With Others. Chapter 6 lists those to whom copies of the EIS and Plan or the Summary were sent.
Glossary	Provides an alphabetical listing of special terms or words and their definition.
Appendix A	Presents a chronology of public involvement activities that were used to develop the significant Issues.
Appendix B	Describes the analysis process used in developing the alternatives. The Appendix focuses on the quantitative methods used to perform the analysis.
Appendix C	Displays a range of outputs estimated for each of the alternatives.
Appendix D	Lists the Technical Reports prepared to document various analyses and planning processes used.

PLANNING REGULATIONS

The following is a digest of the planning regulations in 36 CFR 219 and is a reference for the reader. The regulations are cited often in the Forest Plan and this EIS, and are the legal requirements the planning process must meet.

The Forest Plan or EIS must:

219.11[a] Contain a brief summary of the analysis of the management situation, including demand and supply conditions for resource commodities and services, production potentials, and use and development opportunities;

219.11[b] Contain the Forest multiple use goals and objectives that include a description of the desired future condition of the Forest and an identification of the quantities of goods and services that are expected to be produced or provided during the RPA planning periods;

219.11[c] Contain multiple-use prescriptions and associated standards and guidelines for each management area including proposed and probable management practices such as the planned timber sale program;

219.11[d] Contain monitoring and evaluation requirements that will provide a basis for periodic evaluation of the effects of management practices;

219.12[k] Establish intervals for evaluating how well objectives have been met and how closely management standards and guidelines have been applied. The monitoring requirements identified in the Forest Plan shall provide for:

[1] A quantitative estimate of performance comparing outputs and services with those projected by the Forest Plan;

[2] Documentation of the measured prescriptions and effects, including significant changes in productivity of the land; and

[3] Documentation of costs associated with carrying out the planned management prescriptions as compared with costs estimated in the Forest Plan;

(4) A description of the following activities;

(i) The actions, effects, or resources to be measured, and the frequency of measurements;

(ii) Expected precision and reliability of the monitoring process; and

(iii) The time when evaluation will be reported.

(5) A determination of compliance with the following standards:

(i) Lands are adequately restocked as specified in the Forest Plan;

(ii) Lands identified as not suited for timber production are examined at least every ten years to determine if they have become suited, and that, if determined to be suited, such lands are returned to timber production;

(iii) Maximum size limits for harvest areas are evaluated to determine whether such size limits should be continued; and

(iv) Destructive insects and disease organisms do not increase to potentially damaging levels following management activities.

219.14 Identify lands not suited for timber production.

219.15 Define vegetation management practices for each vegetation type and circumstances including standards, guidelines, and reasons for the management practices. The practices must comply with 219.27(b).

219.16 Include the timber sale schedule which provides the allowable sale quantity.

219.18(a) Provide for limiting and distributing visitor use of specific areas in accordance with periodic estimates of the maximum levels of use that allow natural processes to operate freely and that do not impair the values for which wilderness areas were created; and

219.18(b) Evaluate the extent to which wildfire, insect, and disease control measures may be desireable for protection of either wilderness or adjacent areas and provide for such measures when appropriate.

219.21(a)(3) Identify recreation opportunities on National Forest lands.

219.21(g) Classify areas as to whether off-road vehicle use is permitted as per 36 CFR Part 295.

219.22 Recognize to the extent practicable:

(c) The probable occurrence of various minerals.

(d) The potential for future mineral development and the need for withdrawal of lands from mineral entry.

(e) Access requirements for exploration and development.

(f) Probable effect of renewable resource prescriptions and management direction on mineral resources and activities.

219.23(b) Identification of significant existing impoundments, transmission facilities, wells, and other man-made developments on the area of land covered by the Forest Plan.

(c) Estimation of the probable occurrence of various levels of water volumes, including extreme events which would have a major impact on the planning area;

(d) Compliance with the requirements of the Clean Water Act, the Safe Drinking Water Act, and all substantive and procedural requirements of federal, state, and local governmental bodies with respect to the provision of public water systems and the disposal of waste water;

(e) Evaluation of existing or potential watershed conditions that will influence soil productivity, water yields, water pollution, or hazardous events; and

(f) Adoption of measures, as directed in applicable Executive Orders, to minimize risk of flood loss, to restore and preserve floodplain values, and to protect wetlands.

219.24(a)(2) Identify areas requiring more extensive inventory;

(3) Provide for evaluation and identification of appropriate sites for the National Register of Historic Places;

(4) Provide for establishing measures for the protection of significant cultural resources from vandalism and other human depredation, and natural destruction;

(5) Identify the need for maintenance of historic sites on, or eligible for inclusion in the National Register of Historic Places; and

(6) Identify opportunities for interpretation of cultural resources for the education and enjoyment of the American public.

219.25 Provide for the establishment of Research Natural Areas. Recommendations for establishment of areas shall be made to the Chief through the planning process.

219.28(a) Research needs shall be identified.

2. Alternatives Including the Proposed Action

OVERVIEW

Chapter 2 is the heart of the Environmental Impact Statement (EIS). The proposed action, alternatives considered in detail, and alternatives considered but eliminated from detailed study are described. The major environmental impacts associated with the alternatives are presented in comparative form based on information and analysis presented in Chapter 3, Chapter 4, and the Appendices. The comparisons displayed were selected because they address the issues described in Chapter 1, and clearly show the major differences between the "proposed action" and the alternatives considered in detail. Also included is a summary of the process used to develop alternatives.

Alternatives described and presented in this chapter address the issues in varying degrees. The alternatives display different ways of managing the lands and resources of the Kaibab National Forest. They differ from each other in the land uses and management practices that would occur on different parts of the Forest and in the scheduling of management activities.

Each alternative is a unique combination of management prescriptions and activity schedules applied to the land. As a result, each alternative would generate a different mix of goods and services and a different combination of resource outputs, land uses, and environmental effects.

Time is described in terms of decades. The planning period is the first decade. In some tables, figures are also displayed for future decades, usually the fifth decade, in order to illustrate trends where they might differ under each alternative.

Space is conserved in tables by abbreviating units of 1,000 with "M." A number such as 1,500 may be displayed as 1.5 M. To calculate the actual number, multiply the number by 1,000 where the "M" notation is used. One million is designated "MM."

Unless otherwise stated, all dollars are 1982 values.

REGULATORY REQUIREMENTS

The process of formulating alternatives responded to a number of regulatory requirements. Regulations [40 CFR 1502.14] for implementing the procedural provisions of the National Environmental Policy Act (NEPA) require that agencies:

> Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives that were eliminated from detailed study, briefly discuss the reasons for their having been eliminated;
>
> Devote substantial treatment to each alternative considered in detail including the "proposed action" so reviewers may evaluate their comparative merits;
>
> Include reasonable alternatives not within the jurisdiction of the lead agency;
>
> Formulate reasonable alternatives that may be contrary to existing law or policy to implement, if necessary, to address a major issue identified during t planning process;
>
> Include a "no action" alternative;
>
> Identify the agency's preferred alternative—"proposed action";
>
> Include appropriate mitigation measures not already included in the "proposed action" or other alternatives;

In addition, the National Forest Management Act (NFMA) implementing regulations [36 CFR 219.12[f]] provide the following requirements for formulating alternatives:

> Alternatives shall be distributed between the minimum resource potential and the maximum resource potential to reflect to the extent practicable the full range of major commodity and environmental resource uses and values that could be

produced from the Forest. Alternatives shall reflect a range of resource outputs and expenditure levels;

Alternatives shall be formulated to facilitate analysis of opportunity costs and of resource use and environmental trade-off's among alternatives and between benchmarks and alternatives;

Alternatives shall be formulated to facilitate evaluation of the effects on present net value, benefits, and costs of achieving various outputs and values that are not assigned monetary values but that are provided at specified levels;

Alternatives shall provide different ways to address and respond to the major issues identified during the planning process;

At least one alternative shall be developed that responds to and incorporates the RPA Program tentative resource objectives for each Forest displayed in the regional guide;

At least one alternative shall reflect the current level of goods and services provided by the unit and the most likely amount of goods and services expected to be provided in the future if current management direction continues. Pursuant to NEPA procedures, this alternative shall be deemed the "no action" alternative;

Each alternative shall represent, to the extent practicable, the most cost efficient combination of management prescriptions examined that can meet the objectives established in the alternative;

Each alternative shall state at least the condition and uses that will result from long-term application of the alternative; the goods and services to be produced; the timing and flow of these resource outputs together with associated costs and benefits; resource management standards and guidelines; and the purposes of the management direction proposed.

ALTERNATIVE DEVELOPMENT PROCESS

A broad range of alternatives was formulated by the "interdisciplinary team" (ID team) using a specific and structured analytical process as required in the planning regulations [36 CFR 219.12(e) and (f)].

Analysis Areas

For analysis purposes the Forest was subdivided into units of land called analysis areas. Analysis areas (AA's) were identified based on the issues, biological capability, suitability for management practices, economic factors, and prior allocations.

Prior Allocations

Part of the planning process included evaluating existing allocations of land and evaluating previous plans to determine whether or not they still apply. Some areas of the Forest are subject to specific laws, regulations, or cooperative agreements. The following text lists these areas and the status of previous plans.

Congress established the 47,762-acre Sycamore Canyon Wilderness on March 6, 1972. This wilderness was expanded by additions August 24, 1984 to a total of 55,942 acres. The wilderness is located within three Forests; the Coconino, Kaibab and Prescott National Forests. The Coconino Forest Plan provides management direction for the Sycamore Canyon Wilderness.

In the passage of the Arizona Wilderness Bill (August, 1984), three backcountry areas on the Kaibab National Forest were set aside as Wilderness: 40,600 acres in the Saddle Mountain Wilderness; 67,760 acres of the Kanab Creek Wilderness; and, 4,310 acres of the Kendrick Mountain Wilderness. The remaining 9,019 acres of Kanab Creek are managed by the BLM, and the remaining 2,200 acres of Kendrick Mountain are within the Coconino National Forest. The Kaibab Forest Plan provides management direction for the Kendrick Mountain Wilderness.

The Forest Plan incorporates the analysis made in the environmental impact statement on the Bill Williams Mountain Ski Area Proposal in its entirety. While the decision process represented by this EIS is still not final, the proposal is incorporated by reference for the purposes of analysis in the EIS and Forest Plan.

There are two sites currently listed on the National Register of Historic Places.

There are two designated National Recreation Trails; Camp Clover and Benham. The Beale Wagon Road is designated a National Historic Study Trail (1983) and is evaluated for historic trail status in a technical report and recommended as an historic trail in the Forest Plan.

The Grand Canyon National Game Preserve was established in 1906 and this status still exists on 612,736 acres of the National Forest. The Game Preserve was "set aside for the protection of game animals and birds" and is to be "recognized as a breeding place therefore" [16 USC 684-687]. On areas within this designation "hunting, trapping, killing, or capturing of game animals and birds...[is] unlawful, except under such regulations as may be prescribed... by the Secretary of Agriculture." However, by agreement with the Arizona Game and Fish Commission, wildlife resources are developed and managed on this area in cooperation with the State to include sport hunting. Under the agreement, the state manages wildlife populations under Arizona State law, and the Forest Service gives priority to wildlife in maintaining proper habitat conditions. Under game preserve status the area is closed to mineral entry, but is administered for the other uses for which National Forests are established.

There are presently no "research natural areas" (RNA) designated within the Kaibab National Forest. One potential area representative of an important biotic type is identified by this plan. This area (Garland Prairie Arizona Fescue) will be managed to protect its RNA value until establishment reports are completed and the area is either included in or dropped from RNA consideration.

A review of these prior land allocations showed them to be appropriate. These areas were retained in all alternatives with no further analysis.

Management Prescriptions

Management prescriptions are combinations of management practices, activities, and standards and guidelines designed to achieve specific multiple-use goals and objectives. Management prescriptions include the necessary resource coordination measures required by laws, regulations, and policies. A number of different management prescriptions were developed to emphasize individual resource potentials, to portray current management, to manage at reduced intensity, and to address the issues in a variety of ways.

The prescriptions considered are discussed in Appendix B. Some prescriptions are mutually exclusive, or were not considered in some of the alternatives. Only the prescriptions used in the preferred alternative are presented in the proposed Forest Plan. A description of the full range of prescriptions considered in other alternatives is available for study at the Kaibab National Forest Supervisor's Office.

Benefits and Costs

Resource outputs and costs of implementation for management activities and practices were estimated for each combination of management prescriptions and analysis areas. Refer to Appendix B for a complete listing of the resource outputs and cost categories that were used in the analysis.

Cost estimates for each management prescription were developed from historical records of Forest Service costs and best professional judgement. Non-Forest Service costs for grazing permittee investment necessary to carry out range allotment agreements were also included in the analysis.

The resource outputs that have an existing market and are sold, as well as those resource outputs that could potentially be sold, were assigned benefit values and are called "priced benefits." Timber, fuelwood, dispersed, developed, wildlife, and wilderness recreation, livestock grazing, and water yield were assigned benefit values. All benefit values were based on the point in the production process when the resource is removed from the Forest. Refer to Appendix B for a complete listing of the values used.

No attempt was made to assign benefit values to many other outputs such as visual quality, threatened and endangered species, changes in income and employment, or community lifestyles. These kinds of outputs produce "non-priced" benefits that were also considered in the analysis. Non-priced benefits were considered as constraints or restrictions on the production of priced benefits.

Present Net Value

The priced benefits and the costs of management practices and activities were used to calculate the present net value (PNV) of the alternatives considered in the analysis. PNV is the difference between the value of the priced benefits and the value of all costs, discounted to the present at four percent real discount rate.

Looking at PNV is a means of comparing several different investment opportunities to see which would give the best dollar return. PNV is calculated from the sum of the benefits--the quantity of priced outputs multiplied by the benefit value--minus the sum of the costs necessary to produce the priced and non-priced outputs. The process is roughly equivalent to a private firm or family estimating its income and expenditures over a period of years. Since the dollars that are being added occur over a period of years, some adjustment must be made so they are comparable. A dollar in income now is worth more than a dollar of income ten years from now. The mechanical process by which these dollars are adjusted back to the present year so they can be compared is called "discounting." The discount rate used in Forest planning was established by the chief of the Forest Service.

PNV is a relative indicator of economic efficiency and was used as a means to develop and compare alternatives. One objective in developing each alternative was to maximize PNV. Each alternative is the most economically efficient combination of management prescriptions that will achieve a given set of priced and non-priced goals and objectives.

Net Public Benefits

The NFMA Regulations (36 CFR 219.1) describe the objective of land and resource management planning on National Forest System (NFS) lands:

> The resulting plans shall provide for multiple use and sustained yield of goods and services from the NFS in a way that maximizes long-term net public benefits in an environmentally sound manner.

Since not all costs and benefits can be priced in the analysis, PNV was not the only index used to develop, compare, and evaluate alternatives. Alternatives were evaluated to determine how well they maximized net public benefits. Net public benefits (NPB) is an overall expression of the value to the nation of outputs and positive effects (benefits) less associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index such as PNV. Alternatives having the highest PNV may not always provide the highest net public benefits when non-priced benefits and costs are considered.

Computer Model

The goal in alternative development was to find the most economically efficient combination of management prescriptions that would achieve a given set of priced and non-priced goals and objectives.

A linear programming model called FORPLAN was used as a tool to do the millions of calculations to test possible combinations of areas, prescriptions, and schedules that would maximize economic efficiency (PNV) while meeting the priced and non-priced goals and objectives specified for a given alternative. Goals and objectives for each alternative were determined on the basis of legal requirements, policies, issues, and desired levels of priced and non-priced benefits and costs.

In some cases, the FORPLAN model indicated the Forest could not be managed to meet some combinations of objectives. The limitations of land and resources, an impact on environmental quality, or the practical limits of budgets sometimes caused an infeasible solution. The ID team then modified the objectives and asked the computer model to find other solutions for the particular combination of lands, activities, and schedules that would best meet the objectives of that alternative.

FORPLAN solutions were looked at by the ID team to see if the solutions were workable. Because FORPLAN is only an aid for analysis that does not model all components of net public benefits, adjustments in final solutions were made by the ID team based on professional expertise and prior experience. While the alternatives may not exactly match final FORPLAN solutions, relative differences between alternatives have not been affected. Refer to Appendix B for more detailed discussion of the FORPLAN model and constraints used.

Benchmark Formulation

One phase of the analysis leading to formulation of alternatives was development of benchmarks. A benchmark analysis is an examination (using FORPLAN) that defines the limits of feasibility for managing and using Forest resources.

Benchmarks were designed to emphasize the production of individual resource outputs, to maximize economic efficiency, and to define the least intensive level of management. Benchmarks encompass the range of possibilities from which alternatives can be developed.

Many of the first planning actions involved creating benchmarks and inspecting their outputs, costs, and assumptions. Benchmarks are similar to alternatives. They are a combination of land capability, management practices, and schedules to achieve certain objectives for the Forest as a whole. Unlike alternatives, they are usually not fully implementable, because they lack consideration of likely budgets, specific geographic location, and other details. They do provide significant information about the maximum biological and economic production opportunities, assist in evaluating the compatabilities and conflicts between market and non-market objectives, and define the range within which integrated alternatives can be developed.

Some benchmarks are economics based, while others indicate the maximum physical and, or biological productivity of land for various resources. Each benchmark must meet specified minimum management requirements of 36 CFR 219.27, such as protecting the productivity of the land and meeting minimum air and water quality standards. Benchmarks are described further in Appendix B.

Analysis of the Management Situation

During the analysis of the management situation (AMS), the Forest's current management situation was compared and evaluated against the Forest's potential to supply goods and services as demonstrated by the maximum benchmarks. This analysis provided a basis for evaluating the need for management changes and developing alternatives. The AMS contains much of the documentation for procedural requirements specified in 36 CFR 219, particularly the requirements to be covered in the planning process. The AMS is summarized in Chapter 3 of the EIS, in Chapter 3 of the Forest Plan, and is available in its entirety in the planning record.

Alternative Formulation

Appendix B contains greater detail concerning the formulation of alternatives. In brief, the ID team formulated alternatives by:

Developing a broad range of prescriptions that represent minimum to maximum resource production potentials and expenditures, and which also meet management requirements designed to protect and enhance long-term productivity;

Formulating benchmark alternatives to define the high and low limits or the "decision space" within which alternatives considered in detail were developed; and

Defining goals and objectives for tentative alternatives to be considered in detail by using the range of outputs determined by the benchmarks, issues and concerns to be addressed, cost efficiency, financial feasibility, and non-priced benefits.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

This section deals with those alternatives considered and subsequently eliminated from further study. These alternatives were generated as benchmarks, or as other alternatives considered but not evaluated in detail in the EIS. The reasons they were not considered in detail are presented.

Benchmarks

Because benchmarks define the limits of feasibility, they were considered as potential alternatives and were used as a basis for developing other alternatives. Except for the "current level" benchmark (Alternative A), none are evaluated in detail in the EIS. The "maximize PNV assigned values" benchmark was used as a standard in a number of comparisons between alternatives. Refer to Appendix B for additional detail on benchmarks and the range of alternatives established by benchmarks.

Minimum Level

The purpose of the "minimum level" benchmark is to estimate naturally occurring outputs and unavoidable costs of maintaining the Forest as part of the NFS. This benchmark enables controllable outputs and discretionary costs to be identified. The minimum level is a management strategy that would meet the following statutory requirements: 1) administering unavoidable, non-discretionary land uses; 2) preventing impairment of the productivity of the land; and 3) protecting the life, health, and safety of incidental users. The sum of these activities defines the long-term fixed costs of public ownership without any programs for developing and using resources.

The minimum level benchmark was eliminated from further study because it did not conform to existing legislation governing management and use of the Forest, nor did it address the issues. Although eliminated from further study, the benchmark does provide a basis for comparing base costs and benefits with those alternatives considered in detail.

The minimum level was not modeled in FORPLAN. Outputs and costs were estimated by resource specialists outside the model.

Low Intensity Budget

The purpose of this benchmark is to determine outputs and costs associated with managing the Forest at a low intensity level and, or reduced budget level. This alternative is not considered in detail because the level of management does not respond to the issues and concerns. This benchmark meets only minimum management standards. Some public sector developed recreation sites are operated at reduced service levels and are closed when they deteriorate below minimum health and safety standards. Other government-owned recreation sites are operated under concession special use permits. Trails are closed as they deteriorate below safe use levels or cause excessive erosion. Wilderness is not managed, resulting in significant deterioration of the wilderness resource and experience. Timber production is significantly reduced since funds to perform cultural activities to improve timber growth and to prepare and administer timber sales are not available in this alternative. There is no new construction or reconstruction of roads. Road and facilities maintenance is sharply curtailed. Many roads are closed due to the inability to maintain them at an acceptable level. Buildings deteriorate and no new construction occurs. Grazing capacity and permitted livestock use decline as management declines and improvements deteriorate. Use and capacity balance significantly below current levels. Soil and water treatments are not accomplished and wildlife habitat is not enhanced.

Maximize Single Resources

These benchmarks maximize production of a single commodity-oriented resource while maximizing present net value. They were developed for timber, range grazing capacity, and water yield. As each single resource was maximized in the model, the other resource outputs and activities generally occurred at low intensity levels.

These benchmarks were developed to evaluate the Forest's maximum potential to produce goods and services and to have a point of comparison for the other alternatives' capability to resolve issues. They were used also to test the model's functions in order to set constraints for more workable alternatives.

Single resource benchmarks were eliminated from detailed analysis because each alternative responded to only a few issues while other resources would be managed at low intensity levels. Few constraints were placed on the model during the analysis. Therefore, combinations of budgets and prescriptions assigned by the model for each of these benchmarks did not represent workable solutions. NFMA requires that the Forest Plan provide for multiple use and sustained yield of products and services in accordance with the Multiple Use Sustained Yield Act of 1960. Maximizing a single resource does not satisfy this requirement.

Maximize Present Net Value

Two benchmarks were modeled that maximize PNV. One, called "max PNV market", maximized PNV with market values for timber products, fuelwood sold, permitted livestock use and developed recreation RVD's. The second benchmark, "max PNV assigned values", maximized PNV for resources with market values as well as those with assigned values for water yield, dispersed recreation, wildlife, and wilderness recreation visitor days (RVD's), and free personal-use fuelwood.

These two max PNV benchmarks were not considered in detail because these alternatives met only the cost efficiency criteria. They resolve only a portion of the issues. In some areas, they create unacceptable effects on non-priced benefits such as the assignment of the lowest intensity prescriptions for management of dispersed recreation. This results in reduced quality of experience for the user plus eventual damage to soil, vegetation, and visual resources in popular areas. In addition, the budgets are far in excess of anticipated levels.

Departure Alternatives

Departure from the non-declining yield policy was considered as an alternative, but was not evaluated because none of the conditions listed in 36 CFR 219.16 (a) (3) seem to be indicated for the Kaibab National Forest. These are:

> Several other alternatives already provided a timber offering schedule that met the assigned goals of the RPA Program;

Departure was not necessary to reduce high mortality losses;

A departure would not significantly improve the forest age class distribution above that of the "proposed action" (PA);

Implementation of the base sale schedule from the PA does not cause adverse impact on communities in the economic area of the forest;

It was not reasonable to expect that overall multiple use benefits would be better attained with the departure.

A departure would not satisfactorily resolve any identified issue.

Other Alternatives Considered

Alternatives with output constraints that differ from those presented were considered. It was felt that the alternatives considered in detail and the benchmarks provided an adequate and reasonable range of output options. The ID team decided that none of the issues expressed for the Kaibab could be resolved better by extending the range of outputs presented.

Uneven-aged Management

An uneven-aged timber management alternative was evaluated but not considered in detail for the following reasons.

Uneven-aged management maintains conditions favorable for the perpetuation of dwarf mistletoe, resulting in the increased incidence and severity of infection in the Forest (Forest Pest Management Report R3-85-13). Current loss from dwarf mistletoe in the Forest is estimated to be 30 million board feet per year. Uneven-aged management is not feasible from an economic standpoint. Transportation costs and road densities increase.

Wildlife habitat objectives and diversity goals are unacceptably compromised. Early successional stages in areas managed for timber production are not created, and the needs of some management indicator species are not satisfied.

Uneven-aged management slowly converts some timber stands to climax vegetation. Climax tree species in most habitat types within commercial timberland on the Forest have lower market value than early seral species, in particular ponderosa pine.

ALTERNATIVES CONSIDERED IN DETAIL

Each alternative considered in detail meets the requirements of the NFMA regulations and provides goods and services at a level responsive to all or part of the issues while maximizing present net value. Appendix B describes the model constraints used in formulating the alternatives including alternatives not considered in detail.

The following objectives are common to alternatives:

- Meet the minimum legal management requirements specified in 36 CFR 219.27 in accomplishing goals and objectives of the alternative, including protecting soil and water resources, maintaining habitat to assure viable fish and wildlife populations, and maintaining and improving T&E species habitat;
- Provide for some degree of resolution of all identified issues, within a budget constrained to meet expected levels of financing for the first decade. This constraint was set at $8.1 million annually for all alternatives except the no action (Alternative A).
- Allocate land for the potential development of the Bill Williams Ski Area as defined in a separate EIS.
- Maintain existing representations of ROS classes;
- Maintain existing electronic sites and corridors;
- Provide lands for expanding communities surrounded by NFS lands;
- Recommend establishing Garland Prairie Arizona Fescue Research Natural Area (RNA);
- Maintain an adequate amount and distribution of wildlife habitats throughout the range for all existing native vertebrate species;

— Continue to identify and protect habitats for sensitive, threatened, or endangered plants and animals;

— Implement integrated stand management in all vegetative treatments;

— Achieve a balance between livestock permitted grazing use and grazing capacity;

— Manage range in wilderness areas at management level C;

— Maintain wild burro territory as presently established, within carrying capacity, and consistent with other uses and values;

— Manage fuelwood harvest levels from coniferous forest (including pinyon-juniper woodland) on a long-term sustained yield basis. Collect better information to improve management of coniferous woodland.

In addition to the objectives listed above, the following timber harvest constraints were common to all alternatives to comply with requirements of 36 CFR 219.16(a)(1), (a)(2)(iii), and (a)(2)(iv): non-declining yield (NDY); allowable sale quantity-long term sustained yield capacity link (ASQ-LTSYC); and perpetual timber harvest (ending inventory); and that all stands have reached culmination of mean annual increment (CMAI) before even-aged regeneration harvest.

In project areas, complete cultural resource (CR) surveys, site inventories preliminary site evaluations and consultation with the State Historic Preservation Office (SHPO), and where appropriate with the advisory council, tribal councils and others. Complete project clearance and provide protection of cultural resources through site avoidance, stabilization or other measures as appropriate. Complete compilation of a Forest cultural resources overview.

The 1983 amendment to the National Trails Act (PL 98-11) designated the Beale Wagon Trail from the vicinity of Winona, Arizona, south of state route #15 to the vicinty of Eagle Nest Mountain, as a trail to be studied for national historic importance. The revised Region 3 interim directive #11 assigned the lead effort of the study to the Kaibab National Forest. The twenty-three miles of trail is classified as eligible for "national historic trail" status according to section 5 of the Act. The route is eligible for placement on the National Register of Historic Places and is currently protected by Executive Order 11593.

Issues developed during the scoping process and the response to objectives assigned in the Regional Guide are addressed differently in each alternative. These differing emphases are reflected in the varying mix of management prescription assignments among alternatives. The "proposed action", RPA, and the "no action" alternatives are identified. The FORPLAN model projects resource outputs for 200 years. Resource outputs are displayed for up to fifty years.

The location of areas to be managed under differing prescriptions for the "proposed action" and other alternatives is displayed on the maps that accompany this document.

Range of Alternatives Considered

Each alternative was developed using a differing approach to resolve the issues. It is obvious from examining the issues, that no issue can be completely resolved ultimately without effecting the resolution of some other issue. Therefore each alternative was developed around an overall theme that considered some particular group of issues for emphasis. Separate objectives were developed for each theme, and then each alternative was constructed using sets of management prescriptions designed to fit those objectives. Minimum management requirements were included in all prescriptions. Every alternative therefore resolves each issue to some degree and meets all minimum management requirements. The alternatives considered represent a broad range of reasonable alternatives.

The limits for developing the alternatives were the potential resource production levels achieved by the benchmarks. In all alternatives, a maximum cutoff level was set by either the maximum single resource benchmark, or by expected limits of demand. For example, demand projections for developed recreation use were established based on analyses of past use. The demand projections represent the maximum level of output the Forest could sustain given an unlimited supply of developed recreation capacity. The "low budget" benchmark established the base level for most outputs, with subsequent alternatives providing outputs at or above this level.

Proposed Action (PA)

The "proposed action" (PA) is the proposed Forest Plan that was developed after analysis of the other alternatives. It was designed to emphasize improvement of land productivity and the protection of resource values, while providing for moderate increases from current levels of output for timber, fuelwood, and recreation. It is cost effective, while using state-of-the-art practices for the improvement of wildlife habitats, visual quality and watershed condition. The budget is limited to $8.1 million annually in the first two decades. Other objectives for this alternative, relative to the issues, are:

Commercial Timber

Of the total tentatively suitable land, ninety percent is managed for timber harvest. Growth is 73 percent of the long term sustained yield capacity (LTSYC), in order to better resolve wildlife habitat issues and concerns. Suitable lands are managed to improve age class distribution, stand health and vigor, and to reduce losses from western spruce budworm, dwarf mistletoe, and other forest pests. Following intermediate harvests to specified growing stock levels, stands are seeded to improve forage production.

Wildlife habitats are improved by incorporating diversity goals into silvicultural prescriptions, by reducing the suitable acres allocated to timber harvest, by assigning acres to extended rotations for development of old-growth characteristics, by protecting special habitats such as snags, old-growth, etc., and by increased levels of direct habitat improvement work.

Reliable information is collected from unsuitable and suitable lands that is useful for long-range planning and operational planning.

A sustained level of timber outputs is provided to support local dependent industries. The annual allowable sale quantity of sawtimber and roundwood is 73.3 MMBF.

Fuelwood

Commercial and personal-use fuelwood programs are concentrated in the pinyon-juniper woodland. These programs are used to accomplish timber management objectives, wildlife habitat, soil and watershed, and range forage improvement projects. Increased substitution of conifer residues for the preferred fuelwood sources is encouraged. Fire hazard is reduced.

Reliable information is collected concerning fuelwood resources that is useful for long-range planning and operational planning.

Demand for commercial and personal-use fuelwood is met in the first decade. The annual fuelwood harvest of green pinyon-juniper from the woodland is 8.8 MMBF. In addition, 8.2 MMBF of coniferous residues of timber harvests are available for free and personal-use fuelwood programs.

Range Grazing

Balances grazing use with capacity by the end of the first decade. Gains forage improvement through watershed improvement projects and through fuelwood and timber harvests to the extent that 65 percent of the RPA goal can be met by the fifth decade. Management intensity is moderate.

Watershed Condition

On-site soil loss decreases seventeen percent between periods one through five. Essentially, all of this reduction occurs in the woodland community where substantial improvement work is being accomplished. Water yield varies from a low 298,904 acre-feet per year in period four to a high of 302,689 acre-feet in period five. Watershed condition improves on 196,691 acres through the first five periods going from 349,425 unsatisfactory acres in period one to 152,734 unsatisfactory acres in period five. This alternative represents the third best action for improvements in watershed condition with a corresponding decrease in soil erosion.

Off-road vehicle closures are increased by 24 percent to protect sensitive soils and vegetation.

Achieves a significant reduction in unsatisfactory watershed condition acres through watershed treatments or management changes.

Outdoor Recreation

All developed recreation sites are managed at standard service level. The private sector provides additional developed recreation site capacity in the early planning periods through expansion of existing lodge facilities and construction of new private sector campgrounds under concession special use permits. Public sector investments are deferred in the early planning periods to reduce Forest Service costs.

Dispersed recreation areas are managed to standard service levels. New dispersed water impoundments, vista point improvements, and hiking trail and trailhead investments offer increased dispersed recreation opportunities.

Wilderness areas are managed to protect and maintain wilderness characteristics. Administration efforts are focused in high use areas and along wilderness boundaries.

Transportation System

Manages transportation system to achieve a fifteen percent reduction in miles of unneeded roads in the first decade, while maintaining facilities at appropriate traffic service levels. Constructs or reconstructs the facilities needed to support the outputs planned. Manages road use to prevent resource damage.

Wildlife Habitat

Improves quality and quantity of diverse wildlife habitats and reverse the decline in old-growth habitat.

Cultural Resources

A minimum of two nominations for each professional archeologist on the Forest are made to the National Register of Historic Places per year. A program of cultural resource survey is initiated on lands not planned for work projects.

Minerals Management

Lands potentially valuable for mineral production are available for exploration and development. Special resource values and uses are protected through oil and gas lease restrictions and seasonal constraints imposed on locatable mineral prospecting and exploration activities. Approximately 5,800 acres of additional locatable mineral withdrawals are recommended to protect special resource values.

Alternative A [No Action]

This is the "no action" alternative. It projects current management direction, emphasis, and budget levels. There is a budget constraint of $7,300,000 per year over the first two decades.

The significant issues are partly a result of current management. Therefore, this alternative does not adequately treat the issues as problems to be solved. Chapter 3, The Affected Environment, describes in detail the situations resulting from current management. The following summarizes highlights of the emphasis under the no action alternative.

Commercial Timber

Timber management practices do not resolve the commercial timber issue. All of the tentatively suitable lands are allocated to timber harvest. Dwarf mistletoe infection levels continue to increase, and health and vigor of timber stands declines because silvicultural prescriptions do not address other insect and disease pests.

Reliable information, useful for long-range planning and operational planning is lacking.

A sustained level of sawtimber outputs to support local industries is provided. The annual allowable sale quantity of sawtimber and roundwood is 62.6 MMBF.

Fuelwood

Preferred fuelwood, such as Gambel oak, aspen, and alligator juniper become less available over time, as a result of a Forest-wide personal-use program. Fuelwood theft and degradation of special habitats, such as oak and pine snags, increase.

In the pinyon-juniper woodland, little emphasis is placed on timber management objectives, wildlife habitat, soil and watershed, or range improvement projects. As a result, age class distribution and habitat diversity improve only slightly over time.

Fuelwood demand is met for the entire planning period. The annual fuelwood harvest of green pinyon-juniper from the woodland is 5.2 MBF. In addition, 7.0 MMBF of conifer residue from timber harvests are available for free-use and personal-use fuelwood programs.

Range Grazing

Grazing capacity would improve slowly, resulting in reductions in permitted use in the first decade to achieve a balance, and only reaching 67 percent of the RPA target by the fifth decade. Management intensity is moderate.

Watershed Condition

On-site soil loss decreases ten percent between periods one through five. Water yield varies from a low of 299,786 acre-feet per year in period four to a high of 302,653 acre-feet per year in period one. Watershed condition improves on 116,836 acres by the fifth period. This alternative represents the next to lowest improvement in watershed condition. Low levels of direct watershed improvement work are scheduled.

Off-road vehicle use is restricted only on currently restricted areas.

Outdoor Recreation

Recreation use reaches developed site capacities at the end of the first planning period. A gradual decline in public sector site capacity results from inadequate facility maintenance and eventual closure of sites failing to meet minimum safety and sanitation standards.

Dispersed recreation areas are managed at the less than standard service level. Available maintenance dollars are invested in the more heavily used trails. Other trails deteriorate and are closed when they become hazardous or present resource problems.

Wilderness values decline from lack of administration in high use areas. Periodic patrols along wilderness boundaries prevent major intrusions of non-conforming uses.

Transportation System

Transportation management would continue to receive emphasis, particularly in timber sale areas. Approximately 200 miles of unneeded road would be obliterated per decade. Road maintenance would be adequate for user safety and resource protection, but not adequate for investment protection.

Wildlife Habitat

Acres of old-growth would decrease slightly over time and eventually be scarcely above minimum management requirements.

Alternative A results in less abundance and distribution of "interspersed habitats." Few improvements are made; the "comprehensive plan" is met at moderate levels.

Cultural Resources

A minimum of two nominations to the National Register of Historic Places by each professional archeologist on the Forest are made each year. The major emphasis

of the cultural resource management program continues to be site identification and protection in advance of ground disturbing projects.

Minerals Management

Oil and gas lease applications and locatable mineral proposals continue to be processed with minimal coordination of other resource emphases. Approximately 700 acres of additional locatable mineral withdrawals are recommended to protect existing developed recreation sites.

Alternative B (RPA)

Alternative B would produce the outputs assigned in the regional guide at the least cost. This alternative could be considered to be more capital intensive rather than land intensive, as compared to the other alternatives. The budget is limited to $8.1 million annually, in the first decade.

Commercial Timber

Approximately 94 percent of the tentatively suitable land base is managed for timber harvest. Growth and LTSYC are less under this alternative than the proposed action, because fewer stands are regenerated in the first decade and less investments are made in cultural treatments. Following intermediate harvests to specified growing stock levels, stands are seeded to improve forage production.

Reliable information is collected from suitable and unsuitable lands that is useful for long-range planning and project planning.

A sustained level of timber outputs to support local dependent industries is provided. The annual allowable sale quantity of sawtimber and roundwood is 73.2 MMBF.

Fuelwood

Commercial and personal-use fuelwood programs are concentrated in the pinyon-juniper woodland. These programs are used to accomplish timber management objectives, wildlife habitat, soil and watershed, and range forage improvement projects. Increased substitution of coniferous residues for the preferred fuelwood sources is encouraged. Fire hazard is reduced.

Reliable information is collected concerning fuelwood resources that is useful for long-range planning and project planning.

Demand for commercial and personal-use fuelwood is met in the first decade. The annual fuelwood harvest of green pinyon-juniper from the woodland is 9.8 MMBF, the highest output of any alternative. In addition, 8.2 MMBF of coniferous residue of timber harvest are available for free and personal-use fuelwood programs.

Range Grazing

There would be an increase in forage, resulting in the highest grazing output of 93 MAUM's annually by the fifth decade or 16 MAUM's greater than current. Grazing capacity and use are balanced in the first period. Alternative B achieves 83 percent of the RPA fifth period goal and has a high management intensity.

Watershed Condition

On-site soil loss decreases 23 percent between periods one through five. Water yield varies from a low of 301,042 acre-feet in period four to a high of 303,996 acre-feet in feet per year in period five. Watershed condition improves by 265,690 acres through the first five decades. This alternative represents the best action in addressing watershed issues and concerns.

Sensitive soils and vegetation are protected through additional off-road vehicle closures which represent a 24 percent increase over current.

Outdoor Recreation

Developed recreation demand is essentially met, and there is a substantial increase in developed site capacity, primarily in the private sector. Developed recreation investments are concentrated in the first three planning periods. Many government-owned campgrounds are operated by the private sector through concession special use permits.

Dispersed recreation is managed at the standard service level. Additional hiking trails, trailheads and water developments provide increased dispersed recreation opportunities.

Wilderness characteristics are maintained through regular scheduled patrols of high use areas and along wilderness boundaries.

Transportation System

Transportation management would be emphasized, particularly in the commercial forests. In non-timbered areas, road maintenance would be adequate to provide user safety but roads would disinvest at the current rate. About 500 miles of road would be obliterated by the third decade.

Wildlife Habitat

Acres of old-growth would continue to increase due to selection of least cost prescriptions, but at one of the lowest rates of all alternatives. "Between stand" diversity and age class distribution would continue to develop at relatively low levels.

Habitat improvement is at a moderate level. The comprehensive plan objectives are met at a moderate level. Habitat diversity is at a moderate level.

Cultural Resources

A minimum of two nominations to the National Register of Historic Places are made by each professional archaeologist on the Forest every year. A program of cultural resource survey is initiated for non-project lands.

Minerals Management

Alternative B relaxes surface occupancy restrictions affecting locatable, leasable and saleable minerals. Approximately 3,500 acres of additional locatable mineral withdrawals are recommended to protect special resource values and uses.

Alternative C

This alternative is designed to emphasize non-commodity outputs, such as dispersed recreation, cultural resource, wildlife, and wilderness recreation, and satisfactory watershed condition. Relatively low outputs of market priced commodities, such as timber and livestock grazing are produced. A budget constraint of $8.1 million annually is used.

Commercial Timber

Approximately 74 percent of the tentatively suitable acres are allocated to timber harvest. Growth and LTSYC under Alternative C are slightly less than the proposed action.

Suitable lands are managed to improve age class distribution, stand health and vigor, and to reduce losses from western spruce budworm, dwarf mistletoe, and other forest pests. Following intermediate harvests to specified growing stock levels, stands are seeded to improve forage production.

Reliable information is collected from unsuitable and suitable lands that is useful for long-range planning and project planning.

A sustained level of timber outputs to support local dependent industries is provided. The annual allowable sale quantity of sawtimber and roundwood is 66.6 MMBF.

Fuelwood

Fuelwood management under this alternative is similar to the proposed action. Projects are concentrated in the pinyon-juniper woodland, and fuelwood harvest is used to accomplish other resource objectives.

Increased substitution of coniferous residues for preferred fuelwood sources is encouraged.

Reliable information concerning fuelwood resources, that is useful for long-range planning and project planning, is collected.

Fuelwood demand is met for the first decade. The annual fuelwood harvest of green pinyon-juniper from the woodland is 7.5 MMBF. In addition, 7.4 MMBF of coniferous residue of timber harvest is available for free and personal-use fuelwood programs.

Range Grazing

Permitted grazing use and capacity would be in balance by the end of the second decade. Grazing capacity would decline in succeeding decades, due to disinvestment of range improvements and a low intensity of management, to the lowest level of all the alternatives, amounting to only 58 percent of the RPA target by the fifth decade.

Watershed Condition

On-site soil loss decreases fifteen percent between period one through five. Water yield varies from a low of 295,202 acre-feet per year in period four to a high of 302,556 acre-feet in period one. Watershed condition improves by 188,480 acres through the first five decades. This alternative adequately addresses watershed issues and concerns, and improves watershed values.

Off-road vehicle use is managed at a higher intensity, resulting in a 24 percent increase of area closures above current.

Outdoor Recreation

Alternative C increases developed recreation capacity through construction of new sites in both the public and private sectors. Most public sector investments are deferred until the latter planning periods. Public sector sites that do not generate user fees are managed at less than standard service level.

Dispersed recreation investments are at a moderate level and popular dispersed camping areas are managed at standard service level.

Wilderness characteristics are enhanced through regular scheduled patrols and increased visitor contacts. Non-conforming uses are eliminated.

Transportation System

A low level of road investment would also result in the least road reconstruction and construction, although maintenance levels would be adequate, resulting in a low level of road disinvestment.

Wildlife Habitat

Alternative C has a level of investment in wildlife habitat improvement almost as high as the proposed action in the first decade amounting to 14,000 acres annually. Although a relatively small acreage of suitable timber is devoted to extended rotations, the larger area of unsuitable acres results in the greatest area qualifying as old-growth by the fifth decade (210,000 acres).

This alternative has the largest increase in diversity of habitats and habitat capability. It provides a high degree of accomplishment for the comprehensive plan.

Cultural Resources

A minimum of two nominations to the National Register of Historic Places are made by each professional archaeologist on the Forest every year. A program of cultural resource survey is initiated for non-project lands.

Minerals Management

Alternative C has the third highest number of surface occupancy restrictions affecting locatable, leasable and saleable minerals. Approximately 5,800 acres of additional locatable mineral withdrawals are recommended to protect special resource values.

Alternative D

Alternative D would intensively manage the Forest for commodities having market value including wood products, livestock forage and developed recreation. Management of other resources would be at economical and environmentally feasible levels consistent with emphasis on market outputs. This emphasis would result in some reduction of amenity outputs where there are resource and, or budget conflicts. There would be a budget constraint in the first decade of $8.1 million per year.

Commercial Timber

Approximately 88 percent of the tentatively suitable acres are managed for timber harvest. Growth and LTSYC are slightly less under this alternative than the proposed action. Suitable lands are managed to improve age class distribution, stand health and vigor, and to reduce losses from western spruce budworm, dwarf mistletoe, and other forest pests.

Following intermediate harvests to specified growing stock levels, stands are seeded to improve forage production.

Reliable information is collected from suitable and unsuitable lands that is useful for long-range planning and project planning.

A sustained level of timber outputs to support local industries is provided. The annual allowable sale quantity of sawtimber and roundwood is 69.7 MMBF.

Fuelwood

Fuelwood management under this alternative is similar to the proposed action. Projects are concentrated in the pinyon-juniper woodland, and fuelwood harvest is used to accomplish other resource objectives.

Increased substitution of coniferous residues for preferred fuelwood species is encouraged.

Reliable information concerning fuelwood resources, that is useful for long-range planning and project planning, is collected.

Fuelwood demand is met for the first decade. The annual fuelwood harvest of green pinyon-juniper from the woodland is 8.9 MMBF. In addition, 7.8 MMBF per year of coniferous residue of timber harvest is available for free and personal-use programs.

Range Grazing

Grazing capacity is the second highest of the alternatives, reaching 81 percent of the RPA goal by the fifth decade. This alternative also represents a high intensity of grazing management and balances grazing use and capacity in the first period.

Watershed Condition

On-site soil loss decreases 22 percent between periods one through five. Water yield varies from a low of 298,685 acre-feet per year in period four to a high of 304,957 acre-feet in period five. Watershed condition improves on 257,143 acres through the first five decades. This action represents the second highest improvement in watershed condition through the fifth period.

Additional off-road vehicle closures represent a two percent increase above current.

Outdoor Recreation

Most public sector sites are managed at standard service level. Several government-owned campgrounds are operated by the private sector under concession special use permits to reduce costs to the government. Increased capacity in the first two planning periods is largely dependent on private sector investments.

Most dispersed recreation areas receive maintenance on a regular basis. No additional dispersed recreation investments are made.

Wilderness characteristics are protected and maintained through patrols of high use areas and along wilderness boundaries.

Transportation System

Alternative D would emphasize a highly developed transportation system to produce market outputs. Local road disinvestment would be reduced to its lowest level in this alternative.

Wildlife Habitat

Acreage assigned to extended timber rotations is almost as high as Alternative C. Due to the higher acreage assigned to the suitable timber category only about half as much acreage meets the old-growth stage of development as in Alternative C by the fifth decade.

This alternative attains only a moderate level of meeting comprehensive plan objectives. Diversity in habitats is maintained at a relatively low level.

Cultural Resources

A minimum of two nominations to the National Register of Historic Places by each professional archaeologist on the Forest are made every year. A program of cultural resource survey of non-project lands is initiated.

Minerals Management

Alternative D is the least restrictive alternative in terms of surface occupancy constraints that affect locatable, leasable and saleable minerals. Approximately 3,350 acres of additional locatable mineral withdrawals are recommended to protect special resource values and uses.

Alternative E

This alternative is based on an analysis of a maximum PNV using assigned values, and a budget constraint of $8.1 million annually for the first decade. The emphasis on prudent economic investment results in high outputs of revenue producing outputs, such as timber. Investments with low rates of return, such as grazing and higher cost amenity outputs, such as dispersed recreation are produced at relatively low levels. Management of all outputs is at environmentally feasible levels consistent with the emphasis on high rates of return on investment.

Commercial Timber

Approximately 99 percent of the tentatively suitable land base is managed for timber harvest. Growth and LTSYC are higher under this alternative than the proposed action, because more acres are regenerated in the first decade, and more investments are made in cultural treatments. Suitable lands are managed to improve age class distribution, stand health and vigor, and reduce losses from western spruce budworm, dwarf mistletoe, and other forest pests. Following intermediate entries to specified growing stock levels, stands are seeded to improve forage production.

Reliable information is collected from unsuitable and suitable lands that is useful for long-range planning and project planning.

A sustained level of timber outputs to support local dependent industries is provided. The annual allowable sale quantity of sawtimber and roundwood is 99.8 MMBF.

Fuelwood

Fuelwood projects are concentrated in the pinyon-juniper woodland, and fuelwood harvest is used as the tool to accomplish other resource objectives, however fewer acres are treated under this alternative than the proposed action.

Increased substitution of coniferous residue for preferred fuelwood sources is encouraged.

Reliable information concerning fuelwood resources, that is useful for long-range planning and project planning, is collected.

Fuelwood demand is met for the entire planning horizon. The annual fuelwood harvest of green pinyon-juniper from the woodland is 5.1 MMBF. In addition, [illegible] coniferous residue of timber harvest is available for free [illegible]

[illegible] is balanced in the second decade. [illegible] current level to 69.3 MAUM's annually in the first [illegible] of investment in range improvements, and a low [illegible] achieves sixty percent of the fifth

[illegible] ten percent between periods one through five. Water [illegible] from 302,400 acre-feet in period one to 310,873 acre-feet in period five. Watershed condition improves on 109,403 acres through the first five decades. The action represents the worst alternative in regards to improvements in watershed values.

Off-road vehicle closures are increased by 24 percent above current to protect sensitive soils and vegetation.

Outdoor Recreation

Numerous developed recreation investments in both the public and private sectors results in meeting almost all of the estimated demand by the fifth planning period. Most government-owned campgrounds are operated by the private sector through concession special use permits.

Many popular dispersed camping areas are managed at less than standard service levels. New dispersed investments offer increased hiking, fishing and scenic opportunities.

Wilderness patrols in high use areas and along wilderness boundaries serve to protect and maintain wilderness characteristics.

Transportation System

Road investment and density is highest in this alternative. There is also a higher investment in road maintenance activity in order to prevent degradation of the road network.

Wildlife Habitat

This alternative assigns the lowest level of suitable timber acres to extended rotations. As a result this alternative also achieves the lowest old-growth stage acreage of 15,000 acres by the fifth decade, a reduction of 85 percent from current estimated acres.

This alternative achieves a very low level of habitat diversity. The level of meeting comprehensive plan objectives is low.

Cultural Resources

A minimum of two nominations to the National Register of Historic Places are made by each professional archaeologist on the Forest every year. A program of cultural resource survey of non-project lands is initiated.

Minerals Management

Alternative E proposes the greatest number of additional locatable mineral withdrawals to protect special resource values and uses. New site withdrawals total approximately 7,900 acres. Alternative E is also the most restrictive alternative in terms of special surface use stipulations for oil and gas leases and seasonal constraints for locatable mineral prospecting and exploration activities.

COMPARISON OF ALTERNATIVES

The following sections show how each alternative addresses the issues, concerns, and opportunities. There are quantity and quality aspects of each issue. Those quantities associated with the issue are listed in tables to provide some understanding of the effects. The qualitative aspects are dealt with in narrative form. Some of these evaluations are subjective and are based on the professional judgement of the ID Team members.

Issue 1- Commercial Timber

The alternatives affect the timber resource by the intensities of silviculture applied and the acreage managed for timber production. The effects are characterized, primarily, by differences in the acres of suitable timberlands, age class distribution, growth and long-term sustained yield, allowable sale quantities, acres of regeneration harvest, health and vigor of the stands, and acres allocated to extended rotations.

Using the criteria for determining tentatively suitable timber acres, 492,436 acres are classified as tentatively suitable for timber production. The alternatives use different proportions of the tentatively suitable acreage to achieve outputs, goals, and objectives unique to each alternative.

Alternatives A and E allocate 100 percent and 99 percent of the tentatively suitable acres to timber harvest. Alternatives PA, B, C, and D allocate fewer acres to timber harvest, to resolve other resource issues and concerns, primarily wildlife and range. In Alternatives PA, B, C, D, the allocations represent 90, 94, 74 and 88 percent of the total tentatively suitable acreage, respectively.

Each alternative results in a different age class distribution by the twentieth decade. Equal distribution of age classes provides higher and more regular sustained yields, more variety and diversity of habitats, and a higher level of health and vigor in the Forest. The age class distribution, by alternative, for the entire forest is displayed in Chapter 4.

Uniform distribution of age classes is not achieved in the next 200 years in any alternative. Alternative PA displays the best distribution of age classes. Progress is made toward the goal in all alternatives.

Long-Term Sustained Yield Capacity (LTSYC) is a measure of the long-term timber productivity resulting from the management emphasis inherent in each alternative. It is the highest average yield from suitable lands consistent with multiple use objectives of each alternative and a specified management intensity. LTSYC is based on the assumption that the Forest is in a fully managed condition. It is a function of the amount and productivity of suitable acres, and the management intensity of prescriptions assigned and scheduled for an alternative. The maximum annual LTSYC for the Forest is 25.1 MMCF.

None of the alternatives achieve ninety percent of potential growth by the fifth decade. Using ECOSIM, all strata (analysis areas) were modeled as unmanaged except seedlings and saplings. Therefore, the growth for these strata was modeled at only sixty percent of potential. In addition, any regeneration harvests in the third, forth, and fifth decades do not contribute to the growth displayed in the table in Chapter 4. In order to bring growth up to ninety percent of potential by the fifth decade, more acres need to be regenerated in the first decade.

All alternatives illustrate compromises made in silviculture and timber management. Growth in each alternative varies from sixty percent to eighty percent of LTSYC, in order to better resolve other forest resource issues, primarily wildlife and range.

Alternative E best resolves the commercial timber issue because the highest growth rates for the acres allocated to harvest are realized in the shortest time.

Alternative B provides the poorest resolution of this component of the commercial timber issue, as growth rates are only fifty percent of LTSYC.

Table 1. Summary of Commercial Timber Management Characteristics by Alternative

Characteristic	Alternative PA	A	B	C	D	E
Suitable Timber Land (M ACRES)	439.9	492.4	461.2	362.6	430.2	488.0
Annual Growth (MMCF)	15.1	15.7	10.8	12.1	13.1	18.7
Annual LTSYC (MMCF) 1/	20.7	25.1	21.5	17.6	19.8	23.5
Annual Allowable Sale Quantity (ASQ) (MMCF) Decade 1 2/	14.5	12.1	14.5	13.1	13.7	19.5
Average Annual Volume (MMBF) Decade 1	73.3	62.6	73.2	66.6	69.7	99.8
Health and Vigor Ranking 3/	4	3	2	6	5	1
Extended Rotation (M ACRES) 4/	65,600	14,700	29,800	68,500	44,100	14,700

1/ LTSYC is a measure of the long-term productivity.

2/ Sawtimber and products are included. The ASQ represents a maximum production ceiling. Actual harvest levels may be less than ASQ.

3/ A ranking of 1 represents the best stand health and vigor; a ranking of 6, the poorest.

4/ These acres are allocated to extended rotation to supplement existing old-growth.

The current average annual allowable sale quantity (ASQ) for the Forest is 64 MMBF (12.8 MMCF). The ten-year average (1975-1984) for sawtimber and product volume sold has been 63.8 MMBF per year.

Under Alternative A the ASQ is reduced slightly below current levels. Under Alternatives PA, B, C, D, and E the ASQ is increased above current levels. The range of increase varies from four percent under Alternative C to 56 percent under Alternative E.

Health and vigor of timber stands is affected primarily by acres allocated to timber harvest, and the timber management intensity applied to those acres. Growth rate and susceptibility to insects and diseases are measures of stand health and vigor.

Alternative E best addresses the issue of stand health and vigor. Approximately 99 percent of the tentatively suitable acres are allocated to timber harvest, fewer acres are allocated to extended rotations, and more stands are treated with intermediate and regeneration harvests than other alternatives.

In descending order of resolution of this component of the commercial timber issue, the alternatives are E, B, A, PA, D and C.

In most areas of the Forest, there is adequate old-growth to maintain viable wildlife populations. Some areas on the south side of the Kaibab, however, are deficient in old-growth characteristic habitat. Total acres and distribution of this important habitat are increased as additional acres are allocated to extended rotations, and integrated stand management is applied more extensively.

Additional acres allocated to extended rotations supplement existing acres of old-growth. Alternative C allocates the greatest percentage of suitable acres to extended rotations, fourteen percent. Alternatives PA, B, and D allocate thirteen percent, six percent, nine percent respectively. Alternatives A and E each allocate three percent to extended rotations.

Each alternative addresses differently the criteria discussed previously for the resolution of the commercial timber issue. The following table summarizes this previous analysis into a ranking of how well each alternative resolves the overall commercial timber issue.

Table 2. Ranking of Timber Issue Resolution by Alternative

Alternatives					
PA	A	B	C	D	E
2	6	4	5	3	1

A ranking of "1" best resolves the issue.

Issue 2- Fuelwood

The Forest has adequate supplies of total wood fiber to supply current and projected demand for fuelwood. The important portion of the issue is centered on the Forest's ability to provide adequate green pinyon-juniper (PJ) fuelwood, currently the preferred commercial species.

Under all alternatives the primary fuelwood sources are green pinyon and juniper (PJ), and coniferous residues from commercial harvests. Fuelwood is harvested from acres allocated to soil and watershed, and wildlife habitat improvement projects, and timber management overstory removals. Secondary quantities of Gambel oak and aspen are harvested from acres allocated to wildlife habitat improvement projects, only.

The projected demand for green fuelwood is 11 MMBF, annually, through planning period one. By period 5, the projected use for green fuelwood is 13.5 MMBF, annually.

The Forest has adequate productive capability to meet overall demand for personal and commercial use fuelwood for the first decade. To satisfy this demand it is necessary to supplement green PJ with coniferous residues. The alternatives provide for a different mix of green PJ and coniferous residues to meet this total demand.

All alternatives provide additional coniferous residues beyond that needed to meet estimated future demand in the first decade. This additional volume is available if demand for fuelwood increases more rapidly than expected.

All alternatives except A provide for the collection of more complete information from silvicultural examination and forest inventory, that is useful for planning purposes. All alternatives provide for increased substitution of coniferous residues for preferred fuelwood sources, and as a result reduce wildfire fuel loading below current levels. Therefore these criteria do not provide a meaningful basis for comparison of alternative issue resolution.

Table 3. Summary of Average Annual Fuelwood Outputs by Alternative in Planning Period 1

Output	Alternative PA	A	B	C	D	E
Total Fuelwood Output [MMBF]	17.0	12.2	18.0	14.9	16.7	16.3
Pinyon-Juniper [PJ] Fuelwood Output [MMBF]	8.8	5.2	9.8	7.5	8.9	5.1
PJ Percent of Total Fuelwood Output 1/	52	43	54	50	53	31
PJ Percent of Total Projected Use 2/	79	47	88	68	80	46

1/ This display represents the percentage of green PJ fuelwood produced of the total fuelwood produced in the first decade.

2/ This display represents the percentage of green PJ fuelwood produced of the total projected use in the first decade.

The alternative that provides the greatest amount of the preferred green fuelwood species, pinyon and juniper, best resolves the fuelwood issue. In descending order of resolution of the fuelwood issue for the total forest, the alternatives are B, D, PA, C, A, and E.

Table 4. Ranking of Fuelwood Issue Resolution by Alternative

	PA	A	B	C	D	E
Ranking	3	5	1	4	2	6

A ranking of 1 best resolves the issue.

Issue 3-Range

The current estimated grazing capacity on the Forest is 71,000 animal unit months [AUM's]. Permitted use in 1985 was 88,990 AUM's with 62,760 AUM's actually grazed.

Alternative B has very intensive range management strategies employed. Capital investments provide for adequate replacement of existing structural and non-structural improvements along with a high level of new project development. Range capacity increases thirteen percent from the current level of 71,000 AUM's. Capacity and permitted AUM's balance in Period 1.

Alternatives D, PA, and A use moderately intensive range management strategies that also balance capacity and permitted AUM's in Period 1. Capital investments provide for adequate replacement of existing structural and non-structural improvements. Some investment is made in new project development to maintain existing capacity and improve livestock distribution. Some impacts to local permittees will occur. When the impacts are related to current actual grazing numbers , the resultant capacities in these alternatives show the permittee impact to be small.

Alternatives C and E employ extensive range management strategies. Livestock reduction is the primary method used to balance permitted and capacity AUM's in Period 2. Existing range investments would be lost and no new investments planned.

Capacity declines three to ten percent by the end of Period 2. Significant impacts to the range permittees would result as livestock reductions are implemented.

Table 5. Summary of Range Management Characteristics by Alternative

Characteristic	Alternatives PA	A	B	C	D	E
Management Intensity 1/	3	4	1	5	2	6
Capital Investment 2/	M	M	H	L	MH	L
Period of Balance 3/	1	1	1	2	1	2
Capacity at Balance (M AUM's)	73	73	80	65	77	69

1/ "1" equals most intensive, "6" equals most extensive.

2/ "H" equals all existing investments replaced, high levels of new project investment.
"MH" equals all existing investments replaced, moderately high levels of new project investment.
"M" equals majority of existing investments replaced, low levels of new project investment.
"L" equals majority of existing investments not replaced, no new project investment.

3/ Period of balance means the period when permitted use equals Forest grazing capacity. When balance occurs by the end of the period, the average annual outputs shown in Table 29 will appear to be out of balance.

Table 6. Ranking of Range Issue Resolution by Alternative

	Alternatives PA	A	B	C	D	E
Ranking	1	1	2	4	1	3

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Resolution of the range issue can be described from two points of view. The first point of view centers around bringing permitted use in balance with the actual capacity of the resource. The second point of view is that reductions in permitted use will have adverse impacts to permittees with long standing permits. The alternatives that best resolve the issue balance actions appropriate with both points of view, while minimizing management costs.

Issue 4-Watershed Condition

This issue relates to the requirement not to impair soil productivity. The two most readily measureable factors that describe long-term effects on soil productivity are soil loss and acreage in unsatisfactory watershed condition. Table 7 compares these factors by alternative.

Improvements in watershed condition will occur in all alternatives as a result of direct treatments and, or balancing permitted livestock use with Forest capacity. However, only under Alternatives PA, B, C and D will enough soil and water improvement be done to change condition classes on all watersheds.

Alternatives A and E will show gradual improvement, but the improvement will not be sufficient to change condition classes on all watersheds.

Soil loss, like watershed condition, exhibits rates lower than are presently occurring. The highest decreases occur under Alternatives PA, B, C and D with the lowest decreases in Alternatives A and E. Soil losses diminish by increasing ground cover through direct project work and improved range management.

Table 7. Percent Reduction from Current Average Soil Loss and Unsatisfactory Watershed Condition Acreage in Period 5

	Alternatives					
	PA	A	B	C	D	E
Soil Loss	-17	-10	-23	-15	-22	-10
Unsatisfactory Watershed Condition	-56	-33	-76	-49	-74	-32

Alternatives that improve watershed condition the quickest and reduce on-site soil loss the most, resolve this issue the best.

Table 8. Ranking of Watershed Condition Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	3	5	1	4	2	6

Alternatives with the same ranking resolve the issue equally well, a ranking of 1 is the best.

Issue 5-Developed Recreation

Developed recreation issues and concerns deal with maintenance levels of existing sites and opportunities for providing additional developed recreation capacity. The alternatives provide for different combinations of management intensity for existing sites and various mixes of new public and private sector recreation investments to address these issues and concerns.

Alternatives PA and C essentially maintain the current mix of public and private sector capacity and output reflected under Alternative A. Unlike Alternative A, however, both of these alternatives shift the preponderance of capacity and use in the latter planning periods to the private sector. Alternatives B, D and E result in a dramatic change from the current even mix of capacity and output through the conversion of public sector campgrounds to concession operation, and emphasis on expansion of private sector sites and new private sector recreation investments.

All alternatives except Alternative A rely heavily on the private sector to provide the additional capacity needed to satisfy projected developed recreation demand. Private sector investments are greatest in the first few planning periods under Alternatives PA, A and E. Alternative C postpones the construction of several private sector sites until the fifth decade. New public sector sites are scheduled in the early planning periods under Alternatives B, C, D and E.

Public sector investments are deferred in Alternative PA to the latter planning periods to reduce Forest Service construction and maintenance costs.

Table 9. Summary of Developed Recreation Management Characteristics by Alternative

Characteristics		PA	Alternatives A	B	C	D	E
Total Annual Developed Use (MRVD)	Decade 1	590	537	595	585	590	595
	Decade 5	984	548	1115	1022	1020	1110
Percent of Estimated Demand Satisfied	Decade 1	99	90	100	98	99	100
	Decade 5	66	37	75	68	68	74
Total Additional Site Capacity All Decades (PAOT)*		3600	0	3960	3960	3885	3960
Total Average Annual Developed Recreation Budget (M$)	Period 1	268	224	179	280	220	141
	Period 5	330	224	248	365	282	210

* Excludes the 2000 PAOT's which would result from the construction of the Bill Williams ski area.

Alternatives PA, B, D and E operate and maintain all public sector sites to standard service level. To accomplish this, however, Alternatives B, D and E convert several public sector fee sites to concession operation. Alternatives PA and C are the only alternatives that provide for Forest Service operation and maintenance of all public sector sites.

Alternatives A and C maintain some sites to less than standard service level. This may ultimately result in the closure of certain facilities and sites if conditions fall below minimum health and safety standards. Under Alternative A, several public sector fee sites, campgrounds where overnite use fees are charged, are managed at less than standard service level. Public sector recreation fee sites are one of several major revenue producers for the Forest Service. Less than standard management of public sector fee sites may eventually lead to the deterioration of these sites below standards which qualify them for fee collections. Under Alternative C, visitor information centers, snow play areas and scenic overlooks are managed at less than standard service level. Even though these facilities are non-revenue producers, they are essential to provide a wide spectrum of developed recreation opportunities.

The developed recreation issue primarily addresses the Forest's ability to provide adequate amounts and kinds of recreation with high user satisfaction. Alternatives that provide additional recreation capacity, manage developed sites in an efficient manner and retain developed sites in the public sector best resolve this issue.

Table 10. Ranking of Developed Recreation Issue Resolution By Alternative

	PA	A	Alternatives B	C	D	E
Ranking	1	4	3	2	2	3

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Issue 6-Downhill Skiing

Significant public interest exists for the development of alpine skiing facilities. An opportunity for a ski area exists on Bill Williams Mountain. Capture of this opportunity may impact wildlife habitats, visual resources, watershed condition, and the yield of other resource outputs.

A separate EIS has been prepared to discuss opportunities and impacts of new ski area development. A final decision has not been made on that land allocation. The supporting analysis and decision when rendered will be incorporated in this document and become a part of each alternative. Therefore, the issue resolution of each alternative can be considered equal.

Table 11. Ranking of Alpine Skiing Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	1	1	1	1	1	1

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Issue 7-Dispersed Recreation

The dispersed recreation issue revolves around providing a wide array of recreation opportunities at management levels that provide for high user satisfaction.

Dispersed recreation opportunities are a function of the Recreation Opportunity Spectrum (ROS) composition of the Forest, maintenance frequency of popular dispersed areas and the number and type of dispersed recreation facilities offered under the alternatives. The ROS composition remains constant in all alternatives, but the level of management and proposed dispersed investments do vary by alternative.

Although projected outputs are similar for all alternatives, they are influenced by certain management practices under several alternatives. Reduced outputs under Alternatives A, D and E are a result of fewer dispersed investments or decreased levels of road maintenance in the roaded natural ROS setting.

Alternatives PA, B and C manage the entire Forest at standard service level. Under these alternatives, and to some extent Alternatives D and E, inspection and maintenance of facilities and popular dispersed camping areas is performed on a regular scheduled basis. News releases, interpretive signing and other information services are provided at increased levels. Alternatives A, D and E provide for less than standard management of all or portions of the Forest. Maintenance of popular dispersed camping areas and facilities occurs at minimum levels under these alternatives and user satisfaction may be less. Accumulated evidence of use may detract from the natural setting of popular dispersed areas. Area and facility closures may be necessary to prevent resource damage.

Dispersed recreation investments are proposed under Alternatives PA, B, C and E. Dispersed investment opportunities are highest under Alternative PA and lowest under Alternative C. Alternatives PA, B and E provide for similar opportunities in planning period 1. Fewer dispersed investments are schedule in the second planning period in all of the alternatives.

Table 12. Summary of Dispersed Recreation Management Characteristics by Alternative

Characteristics		PA	A	B	C	D	E
				Alternatives			
Average Annual Dispersed Output* (M RVD)	Decade 1	279	255	279	279	255	254
	Decade 5	426	379	423	421	381	385
Average Annual Dispersed Maintenance Budget (M$)	Period 1	$149	$130	$149	$149	$129	$122
Proportion of Forest Area Managed at STD and LSTD** in Percent							
Service Levels	STD	100	0	100	100	74	69
	LSTD	0	100	0	0	26	31
Average Annual Dispersed Investment Costs (M$)	Period 1	$13.3	0	$11.7	$7.1	0	$11.6
	Period 2	$3.5	0	$4.7	$1.1	0	$4.1
Acres Closed to Off-road Vehicle Use (MAcres)		14.5	11.4	14.5	14.5	11.9	14.5

* Output projections exclude projected average annual highway use of 692 MRVD's and use associated with wildlife activites.

** STD - Standard Service Level
LSTD - Less than Standard Service Level

All of the alternatives except Alternative A provide for additional ORV closures to protect resource values and prevent user conflicts. Resource damage in certain sensitive areas is likely to occur from unrestricted vehicle use under Alternatives A and D.

All alternatives provide opportunities for off-road vehicle recreation. The Forest is generally well-roaded and has many miles of primitive roads where off-road vehicles can travel without actually going "off-road" where resource damage can occur.

Alternatives which provide for the highest percentage of standard service level and the greatest investment in support facilities best resolve the issue.

Table 13. Ranking of Dispersed Recreation Issue Resolution by Alternative

	PA	A	B	C	D	E
			Alternatives			
Ranking	1	6	2	3	4	5

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Issue 8- Transportation System

The goal for the transportation system is to provide safe, cost effective roads for Forest users consistent with objectives of each alternative. Currently there are 946 miles of arterial and collector roads and 5,745 miles of local road for a total of 6,691 miles.

Table 14. Average Annual Transportation Management Characteristics by Alternative in Period 1.

Characteristics [1]	Alternatives PA	A	B	C	D	E
P.C. Reconstruction (Miles)	53.6	53.3	54.4	49.0	50.2	72.8
P.C. Construction (Miles) [2]	2.7	2.8	3.9	2.5	3.1	3.8
C.I. Reconstruction (Miles)	25.4	24.6	26.6	24.9	25.6	17.9
Road Obliteration (Miles)	33.2	23.4	31.2	52.8	30.3	30.0
Road Maintenance Funds (M$) [3]	575.3	533.9	585.6	554.3	550.8	594.7

1/ P.C. is Purchaser Credit; C.I. is Capital Investment.
2/ New construction is less than five miles per year to access timber in the first decade. New construction gradually declines to zero by the end of the second period.
3/ These are total road maintenance funds including funds supporting timber harvests and recreation activities.

Timber harvest generates most road development on the Forest. Timber purchasers receive credits for reconstructing or constructing roads needed to access the sale areas. Timber road reconstruction/construction miles change directly as timber harvest volumes change by alternative. Any new construction would be limited to local roads directly associated with timber harvest. New construction by alternative averages less than five miles per year and is needed to access timber for harvest in the first decade. New construction would approach zero miles by the end of the second decade when first entry into sale areas is completed.

Non-timber purchaser road projects are funded by capital investment dollars. This funding is mainly for arterial/collector road reconstruction. No alternative requires new construction of arterial or collector roads.

All Alternatives except E provide funding to reconstruct roads at a rate commensurate with their rate of deterioration from use and weather. The arterial/collector road system would be reconstructed on about a thirty-year rotation. At the time of reconstruction, work would be required to reestablish drainage structures, rebuild the subgrade, upgrade the running surface and meet current safety requirements. These funding levels will protect the majority of the road investment and have a minimal impact on the surrounding resources. In Alternative E, it would take about forty years to reconstruct the system. The same work would be required as in the other alternatives, but there would always be some roads that do not meet management needs, do not provide user comfort and economy, and provide limited access by some low clearance vehicles and during wet weather. This road disinvestment could also cause some resource damage.

All Alternatives have a minor increase in road maintenance funding over current levels. This is because funds are appropriated based partly on functional outputs of timber and recreation. Alternatives A and C will continue to maintain roads at their current levels; providing user safety, access for high clearance vehicles on low use roads, access for low clearance vehicles and some user comfort and economy on higher use roads, and a sign maintenance program that provides adequate safety and informational signing. Alternatives PA, D, and E will provide better timber resource access because of the higher timber outputs, surface replacement on a twenty-year cycle, and improved signing for safety and information. Alternative B will provide surface replacement on a ten-year cycle in addition to work performed under the other alternatives. All alternatives provide sufficient funding to protect major road investments and minimize impacts on resources.

Road obliteration mileages include both watershed and road management projects. Some miles are treated with direct project investments and passive closures accomplish the objective on other miles.

Alternatives PA and C provide for the most road obliteration in the shortest time. The rates and amounts of obliteration in the other alternatives are less than Alternatives PA and C. Alternative A accomplishes the least obliteration work. Resultant managed road systems would be the smallest in Alternatives PA, B, C and D. The other alternatives (A and E) would have the largest systems.

The alternatives that provide road maintenance to minimize road disinvestment provide for road access, and manage unneeded roads through closures or obliteration achieve the best balance of issue resolution.

Table 15. Ranking of Transportation Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	2	6	4	1	3	5

Alternatives with the same ranking resolve the issue equally well. A ranking of "1" is the best.

Issue 9 - Wildlife Habitat

Resource management alternatives change habitat conditions on the Forest and this change is indicated through impacts on the management indicator species. These indicator species were chosen because their population changes are believed to indicate the effects of management activities on other species of a major biological community. Relative impacts on indicator species are displayed in Table 16.

Table 16. Percent Changes in Habitat Capability for Indicator Species; Projections through Period 5 by Alternative

Species	Alternative					
	PA	A	B	C	D	E
Goshawk	49	23	41	74	26	-3
Pigmy nuthatch	99	55	89	140	92	46
Turkey	2	-5	1	6	3	-7
Red squirrel	43	21	29	93	43	7
Spotted owl	158	62	123	288	150	27
Elk	-4	-7	-7	-3	-3	0
Abert's squirrel	10	5	5	28	10	0
Hairy woodpecker	240	155	252	310	234	161
Yellow-bellied sapsucker	41	27	44	50	36	37
Plain titmouse	2	0	0	-3	0	68
Mule deer	5	-3	4	-5	2	-9
Antelope	7	-10	7	26	3	2

Alternative PA provides the best distribution of diverse habitats for the greatest number of species due to habitat capability and elevated levels of direct and coordinated habitat improvement. Alternative C supplies a balance of habitats and provides the largest increase in late seral stage pine/mixed conifer habitat. Alternatives PA and C result in the greatest habitat capability increase for big game due to increased levels of habitat improvement and coordination with other resource activities. A majority of habitat improvement acres will be in identified big game wintering areas.

Table 17. Ranking of Wildlife Habitat Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	1	5	4	2	3	6

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

In Alternatives B and D, habitat capability is increased at a moderate level. Elk habitat reflects a net decrease while mule deer and turkey habitat show a slight increase. Although Alternative PA shows a relatively static big game habitat capability, slight increases in potential population capacity occur. Old-growth and snag dependent species show a marked increase by the fifth decade over the existing situation. Alternatives PA and C not only provide for elevated levels of habitat improvement, but also increased levels of coordination result in upward trends in habitat capability for most species.

Decreases in habitat capability in Alternatives A and E are not offset by coordination activities or habitat improvements. Overall habitat diversity and quality therefore decreases. Old-growth dependent species decline and foraging areas for early succession species in turn decrease.

Alternatives that provide the best distribution of diverse habitats for the greatest number of species resolve this issue best.

Issue 10-Cultural Resources

Cultural resource survey is required under all of the alternatives to support various levels and combinations of fuelwood harvest, commercial timber harvest, soil and watershed improvement and wildlife habitat improvement projects.

Table 18. Summary of Cultural Resource Management Characteristics by Alternative

Characteristic		Alternatives PA	A	B	C	D	E
Average Annual Acres of Cultural Resource Survey (MAcres)	Period 1	20.3	16.5	18.3	14.7	17.5	21.2
	Period 5	16.0	21.6	25.5	14.4	22.2	19.7
Average Annual Cultural Resource Program Funding for Program Administration, Non-project survey and Site Evaluation (M$)	Period 1	$46.7	$20.1	$46.6	$46.7	$37.8	$39.7
	Period 5	$31.8	$20.1	$26.6	$25.6	$19.9	$29.3

Acres requiring cultural resource survey in the first planning period are substantially higher under Alternatives PA and E than in Alternative A. Current level project acres displayed under Alternative A reflect an emphasis on survey requirements in commercial timber areas. Higher acreage figures in the other planning alternatives are largely a result of increased treatments related to soil and watershed and wildlife habitat improvement projects, range retreatments and fuelwood harvests. This has important consequences since these treatments focus on woodland areas which are currently receiving relatively little attention. The shift in project emphasis to woodland treatments under Alternatives PA, B, C and D partially resolves the issue involving the need for survey in non-project areas. Increased survey acreage under Alternative E reflects elevated levels of commercial

timber treatments, rather than woodland treatments. Each of these alternatives satisfies this issue in proportion to the increase survey acreage above current. Alternative PA provides for the greatest quantity of survey in areas not currently receiving much emphasis. Alternatives B, C, D and E provide less coverage, but still allow for survey of woodland areas above the current level reflected under Alternative A.

With the exception of Alternative A, all of the alternatives contain financing specifically earmarked for preparation of an overview document. These alternatives provide for the completion of a cultural resource overview for both the north and south side of the Kaibab in planning period 1.

The funding level under Alternative A reflects financing necessary to perform various administrative duties of the cultural resource management program as currently defined, which are not directly linked to support projects or resolution of the cultural resource issues. Alternatives PA, B, C, D and E also provide for this current level of program administration plus additional financing for issue resolution through survey in non-project areas and for cultural resource site evaluation. Additional financing for non-project survey and site evaluation is similar under Alternatives PA, B and C but somewhat less under Alternatives D and E.

Initial emphasis is directed towards survey of non-project areas under Alternatives PA, B, C, D and E, as opposed to site evaluation. However, site evaluations are accomplished at levels substantially greater than current under all of these alternatives. Under all alternatives, areas suitable for commercial timber production are expected to eventually receive cultural resource survey in connection with timber management activities. As such, the woodland area and transition zone between the woodland and commercial timber types are targeted for the majority of non-project related survey. As information is gained about the distribution and relative significance of sites through project and non-project related survey, program emphasis shifts to site evaluation in the latter planning periods under Alternatives PA, B, C, D and E.

All of the alternatives except Alternative A provide for the protection and management of the Beale Wagon Road on National Forest System lands as a National Historic Trail. Short- and long-term impacts to the trail are the same under these alternatives except for those portions of the trail on non-federal lands. Increased development pressures on private lands may gradually degrade the historic route through these areas. However, significant historic sites and junction points on non-federal lands are protected through cooperative efforts with other land owners under the alternatives.

Each alternative provides that two nominations to the "Register of Historic Places" be made annually by each professional archaeologist.

Alternatives that provide a cultural resource overview, and provide for cultural resource program funding that enables survey of non-project lands and increased site evaluations resolve this issue best.

Table 19. Ranking of Cultural Resources Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	1	4	2	2	3	3

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Issue 11-Wilderness & Special Areas

Alternatives differ in the management of wilderness primarily through the level of funding and resultant intensity of management.

Table 20. Average Annual Wilderness Management Funding (M$) by Alternative

	Alternatives					
	PA	A	B	C	D	E
Period 1	$14.6	$1.0	$14.6	$38.1	$14.6	$14.6
Period 5	$11.5	$1.0	$11.5	$22.5	$11.5	$11.5

Funding under all alternatives except A is adequate to cover costs for trail maintenance and signing, initial boundary posting and maintenance, periodic wilderness patrols and preparation and publishing of maps and information brochures. Additional funding under Alternative C esteblishes two wilderness ranger positions to conduct regular patrols throughout the primary use season. Reductions in financing after the first planning period reflect completion of wilderness boundary description and posting.

With the exception of Alternative A, all wilderness areas are managed at standard service level. Alternatives PA, B, D and E protect and maintain wilderness characteristics by focusing administration efforts in high use areas and along wilderness boundaries. Temporary restrictions may be necessary in concentrated use areas to prevent resource damage under these alternatives. Visitor contacts are infrequent.

Alternative C enhances wilderness characteristics through regular scheduled patrols and visitor contacts in high use areas. Non-conforming uses are eliminated under this alternative. The fire lookout tower and several low power communication installations on the summit of Kendrick Mountain are dismantled and relocated outside the wilderness area under Alternative C.

No additional recreation investments are constructed within wilderness under any alternatives. Existing wilderness trail systems are adequate to serve projected use through the fifth planning period.

The Forest currently does not have any Research Natural Areas. A 300 acre area located east of Williams in Garland Prairie is identified for designation as a RNA. This area represents the Arizona fescue-mountain muhly open prairie bunchgrass vegetation association. A number of sites have been considered Forest-wide and interested and effected parties asked to comment. The area is listed as potential in R-3 Progress Report, Research Natural Area Paper, September 1984, and as a candidate natural area by the State Natural Area Advisory Council. All alternatives provide for designation of this area in this planning period.

Alternatives that protect and enhance wilderness values and provide for special area designation resolve this issue best.

Table 21. Ranking of Wilderness Management Issue by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	2	3	2	1	2	2

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Issue 12- Lands

Issues and concerns deal with administrative problems associated with land needs for the expansion of local communities, access to both federal and private lands and the efficient management of special land use permits.

Table 22. Summary of Lands Management Program Characteristics by Alternative

Characteristic		Alternatives PA	A	B	C	D	E
Average Annual Lands Program Budget (M$)	Period 1	$91.9	$86.7	$92.2	$89.3	$93.8	$82.5
Projected Annual Special Land Use Receipts (M$)	Period 1	$69.5	$47.5	$69.5	$69.5	$69.5	$47.5

Alternatives PA, B, C and D provide for small increases in program funding above the current level reflected under Alternative A. Budget allocations for these alternatives allow for an overall efficient lands management program. Funding under Alternative E results in substantially reduced land exchange, rights-of-way acquisition and other land adjustment programs. Under Alternative E, all lands related program activities are not as responsive to public and administrative needs, and eventually result in reduced revenues from land use occupancy fees.

Land exchange management issues and concerns address the need for additional privately owned lands adjacent to the communities of Williams, Tusayan and Parks without significantly affecting existing land values or economic structures of other communities. National Forest System lands available for private acquistion through exchange currently total 4,875 acres. Alternatives PA, B, C, D and E increase the amount of National Forest System lands available for exchange to 9,119 acres. The majority of this increase is adjacent to Williams, Tusayan and Parks.

Program funding under Alternatives PA, A, B, C and D allow timely response to most land exchange proposals. The reduced budget level under Alternative E precludes undertaking exchange proposals of a complicated nature involving a substantial amount of data gathering and analysis.

Issues and concerns related to the occupancy and use of the National Forest by permit include the timely evaluation of special use applications, efficient administration of permits to protect forest resources, method and interval of special use fee adjustments and the capability to meet needs for additional electronic sites and utility corridors. Resolution of these issues varies by the degree of responsiveness to special land use proposals and the frequency of special use inspections under each alternative.

Alternatives PA, B, C and D provide a level of administration that enables adequate response to public and administration needs. The primary difference between these alternatives involves the frequency and method of fee adjustments. Alternatives A and E only allow infrequent field inspection of permits and fees are based on minimum established rates. The capability to respond to permit applications is substantially reduced under Alternatives A and E.

Lands management funding levels under Alternatives PA, B, D and D enable more frequent and detailed special land use fee determinations which result in substantial projected increases in land use receipts.

Forest Service right-of-way acquistions across private lands continue at the current level under Alternatives PA, A, B, C and D. Needed right-of-way acquisitions across private lands are greatly reduced under Alternative E.

The alternatives that provide for a responsive land adjustment program and an efficient special land use and rights-of-way program resolve this issue best.

Table 23. Ranking of Lands Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	1	3	1	2	1	4

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Issue 13-Minerals Management

Minerals management issues and concerns address the need to ensure access for mineral exploration and development while providing for adequate protection of special resource values. The alternatives affect the accessibility of the minerals resource through the application of various surface use and occupancy restrictions.

Potential impacts of mineral activities on other resources can be qualitatively described based on the degree of restrictions imposed under each alternative.

The degree of mineral restrictions considered under the planning alternatives can be described in relative terms of high, moderate and low. The high restriction level imposes numerous seasonal and permanent operating and occupancy constraints to protect special resource values including important wildlife habitats, recreation, administrative and special use sites, visually sensitive areas, primitive areas, sensitive soils and National Register sites. The moderate level of restrictions protects special values and uses in similar resource categories, but to a lesser extent than the high restriction level. The low restriction level maximizes the area available for mineral exploration and development with minimum constraints to protect special resource values.

Under all restriction levels, the constraints imposed on locatable mineral activities pertain to the prospecting and exploration phase of operations. Constraints generally affect timing of operations. The capability of the Forest Service to influence operations during the mine development and production phases is limited to review of mining plans of operation to ensure reasonable protection of surface resources.

Table 24. Allocation and Degree of Mineral Restrictions on Lands Open to Mineral Entry by Alternative

Degree of Restrictions	Proportion of Total Forest Area Allocated by Alternative in Percent					
	PA	A	B	C	D	E
High Level of Restrictions	27	0	8	13	0	31
Moderate Level of Restrictions	54	42	21	78	20	65
Low Level of Restrictions	19	58	73	9	80	4

Special resource values and uses have the greatest potential to be impacted adversely by mineral activities under Alternatives B and D. Mineral constraints are relaxed over a large portion of the Forest in these alternatives. Important wildlife habitats may be lost or severely impacted during primary use seasons from both locatable and leasable mineral activities.

Alternatives PA, C and E afford greater protection of special resource values and uses than the current level of protection reflected under Alternative A. Locatable prospecting and exploration activities proposed in and adjacent to important wildlife habitats are restricted during primary seasons of use under these alternatives. Special surface use stipulations of oil and gas leases provide protection of most areas with special resource values during all phases of leasable mineral activities. Common variety mineral material removals are prohibited in most visually sensitive roadside corridors, primitive areas and adjacent to important wildlife habitats.

Table 25. Additional Acres of Mineral Withdrawals by Alternative*

	Alternatives					
	PA	A	B	C	D	E
Total Acreage Proposed for Withdrawal	5,781	771	3,509	5,781	3,349	7,891

* Proposed withdrawals restrict locatable mineral entry only. Surface use and occupancy controls available under leasable mineral authorities provide adequate protection of special resource values and uses. Existing withdrawals and special land designations restrict mineral activities on 730,376 acres (see Table 60).

Additional withdrawals are proposed under all planning alternatives. Alternative E affords the greatest protection of special resource values through mineral withdrawals. Due to the low probability for economic mineral occurrences in these withdrawn areas, there are fewer opportunities for mineral production in the withdrawn areas. Although low probability areas may contain important undiscovered mineral resources, it is likely that foregone opportunities for mineral production are insignificant.

The alternatives that best resolve the minerals management issue are the ones that balance minerals accessibility concerns with potential environmental damage concerns.

Table 26. Ranking of Minerals Management Issue Resolution by Alternative

	Alternatives					
	PA	A	B	C	D	E
Ranking	1	3	2	1	3	2

Alternatives with the same ranking resolve the issue equally well. A ranking of 1 is the best.

Summary of Issue Resolution

The table below displays the relative ranking of the alternatives for each of the issues. A ranking of 1 represents the best resolution of the issue, and 6 the least. Some alternatives display equal rankings because their issue resolution is perceived to be equal. These rankings are subjective, but are included here to provide a basis for overall comparison of the alternatives.

Table 27. Issue Resolution Ranking Summary

Issue	PA	Alternatives A	B	C	D	E
Commercial Timber	2	6	4	5	3	1
Fuelwood	3	5	1	4	2	6
Range	1	1	2	4	1	3
Watershed Condition	3	5	1	4	2	6
Developed Recreation	1	4	3	2	2	3
Downhill Skiing	1	1	1	1	1	1
Dispersed Recreation	1	6	2	3	4	5
Transportation System	2	6	4	1	3	5
Wildlife Habitat	1	5	4	2	3	6
Cultural Resources	1	4	2	2	3	3
Wilderness/Special Areas	2	3	2	1	2	2
Land Adjustments	1	3	1	2	1	4
Minerals Management	1	3	2	1	3	2
Overall Ranking 1/	1	5	2	3	3	4

1/ Based on numeric average of above subjective ranking

Alternative Acreage Distribution

Each alternative would result in a different combination of management prescriptions and different acreages assigned to various prescriptions. Table 165 shows the acres assigned to the various prescription levels (combinations of management practices) by each of the alternatives and the benchmarks. A description of how the prescriptions were developed and used in the FORPLAN model is also found in Appendix B.

Alternative A represents the current situation. Prescriptions representing the current situation were allocated in the FORPLAN model. Alternative D allocated a preponderance of the acreage to high commodity emphases. Alternative B allocated a majority of the Forest to high commodity and moderate non-commodity emphasis prescriptions. Alternatives C and E allocate a broad range of choices from both commodity and non-commodity prescriptions. The Proposed Action allocates prescription choices that best address the issues, but also includes a mix of commodity and non-commodity emphases.

Acres Available

Because alternatives result in different combinations of allocation choices, there are differences between them in total acreages available for timber harvest, livestock grazing (full capacity acres), developed recreation sites, and minerals exploration and development. The following table shows these acreages.

Table 28. Acreage Available for Commodity Uses by Alternative

Alternative	Timber Harvest	Livestock Grazing	Developed Recreation	Minerals Locatable	Minerals Leasable
PA	439,994	794,400	3,784	795,923	1,421,210
A	492,436	793,600	1,556	800,933	1,416,770
B	461,209	797,500	3,784	798,195	1,416,770
C	362,642	752,500	3,784	795,923	1,416,770
D	430,197	757,200	3,784	798,355	1,416,770
E	487,960	791,400	3,784	793,813	1,416,770

Resource Outputs

Table 29 displays the alternative and benchmark outputs for all five of the ten-year time periods analyzed (see Appendix B, Table 162 for a more complete listing of outputs). The benchmarks are included so the alternatives can be viewed in perspective with the minimum level and single resource potential outputs. The benchmarks do not contain all of the constraints that were applied to the alternatives to make them financially and legally feasible. The units of measure are indicated for each output.

Table 29. Average Annual Outputs by Alternatives and Selected Benchmarks by Resource Elements

	Alternatives						Benchmarks			
Resource Activity	PA	A	B	C	D	E	Min Level	Max PNV Assigned	Max Timber	Max Range
Public Sector Developed Rec Use-STD (MRVD)										
Decade 1	314	96	113	350	216	57	0	113	113	113
2	318	86	188	363	254	128	0	188	188	188
3	331	0	267	363	333	207	0	267	267	267
4	410	0	269	363	346	208	0	269	269	269
5	417	0	271	456	352	209	0	271	271	271
Public Sector Developed Rec Use-LSTD (MRVD)										
Decade 1	0	156	0	32	0	0	0	0	0	0
2	0	156	0	0	0	0	0	0	0	0
3	0	244	0	0	0	0	0	0	0	0
4	0	244	0	0	0	0	0	0	0	0
5	0	244	0	0	0	0	0	0	0	0
Private Sector Developed Rec Use (MRVD)										
Decade 1	276	223	481	235	374	538	0	481	481	481
2	409	237	623	338	509	682	0	623	623	623
3	552	238	753	424	652	809	0	753	753	753
4	566	238	844	438	667	900	0	844	844	844
5	566	238	844	567	667	901	0	844	844	844
Dispersed Recreation Use-STD (MRVD)										
Decade 1	279	0	278	279	191	233	0	255	61	212
2	319	0	316	316	214	266	0	289	69	245
3	356	0	353	351	238	298	0	322	77	275
4	390	0	387	385	261	325	0	353	85	302
5	425	0	422	420	284	354	0	385	93	329
Dispersed Recreation Use-LSTD (MRVD)										
Decade 1	0	255	1	0	65	21	135	12	2	49
2	0	285	1	0	73	24	135	13	2	56
3	1	317	1	1	81	27	135	15	2	62
4	1	348	1	1	88	30	135	16	2	68
5	1	379	2	1	96	32	135	17	2	74

Table 29 (cont). Average Annual Outputs by Alternatives and Selected Benchmarks by Resource Elements

	Alternatives						Benchmarks			
Resource Activity	PA	A	B	C	D	E	Min Level	Max PNV Assigned	Max Timber	Max Range
Dispersed Highway Rec Use (MRVD)										
Decade 1	692	692	692	692	692	692	692	692	692	692
2	692	692	692	692	692	692	692	692	692	692
3	692	692	692	692	692	692	692	692	692	692
4	692	692	692	692	692	692	692	692	692	692
5	692	692	692	692	692	692	692	692	692	692
Wilderness Use-STD (MRVD)										
Decade 1	7	0	7	7	7	7	0	7	1	7
2	8	0	8	8	8	8	0	8	2	8
3	9	0	9	9	9	9	0	9	2	9
4	10	0	10	10	10	10	0	10	2	10
5	11	0	11	11	11	11	0	11	2	11
Wilderness Use-LSTD (MRVD)										
Decade 1	0	3	0	0	0	0	3	0	2	0
2	0	4	0	0	0	0	3	0	3	0
3	0	4	0	0	0	0	3	0	3	0
4	0	5	0	0	0	0	3	0	3	0
5	0	5	0	0	0	0	4	0	4	0
Wildlife Rec Use (MWFUD)										
Decade 1	181	175	174	190	175	180	172	178	175	175
2	179	173	175	185	175	180	171	178	173	177
3	178	172	176	181	175	179	169	178	172	178
4	176	170	175	176	175	179	168	178	170	180
5	175	169	177	172	175	179	166	178	169	182
Grazing Capacity (MAUM)										
Decade 1	70	71	74	63	71	69	0	71	71	75
2	72	73	80	64	77	69	0	72	74	81
3	74	76	88	66	85	70	0	74	76	93
4	74	77	94	67	90	68	0	74	77	104
5	75	77	112	67	94	70	0	75	77	112
Grazing Permitted Use (MAUM)										
Decade 1	78	78	81	70	77	76	0	77	78	81
2	72	73	80	65	77	71	0	72	73	81
3	73	75	86	65	84	69	0	73	76	89
4	73	75	89	65	87	68	0	72	76	92
5	73	75	93	65	91	67	0	72	76	97
Wild Burro Use (Animals)										
Decade 1	24	24	24	24	24	24	24	24	24	24
2	24	24	24	24	24	24	24	24	24	24
3	24	24	24	24	24	24	24	24	24	24
4	24	24	24	24	24	24	24	24	24	24
5	24	24	24	24	24	24	24	24	24	24
Long-Term Sustained Yield (MMCF)										
	21	25	21	18	20	23	0	24	24	21
Net Merchantable Volume (MMCF)										
Decade 1	15	12	15	13	14	20	0	22	23	42
2	16	16	16	14	16	22	0	22	23	31
3	16	23	18	14	19	22	0	22	23	23
4	16	23	19	16	19	22	0	22	23	27
5	16	23	19	16	19	22	0	22	23	16
ASQ-Sawtimber & Roundwood Timber Sale (MMBF)										
Decade 1	73	83	73	67	70	100	0	112	117	200
2	82	79	82	71	83	115	0	114	117	161
3	79	116	90	72	99	110	0	105	116	116
4	78	110	94	77	96	110	0	109	111	100
5	80	114	93	76	95	107	0	107	114	76

Table 29 [cont]. Average Annual Outputs by Alternatives and Selected Benchmarks by Resource Elements

	Alternatives						Benchmarks			
Resource Activity	PA	A	B	C	D	E	Min Level	Max PNV Assigned	Max Timber	Max Range
Coniferous Residue Fuelwood (MMBF)										
Decade 1	8	7	8	7	8	11	0	6	5	0
2	8	7	8	7	8	11	0	6	5	0
3	8	7	8	7	8	11	0	6	5	0
4	8	7	8	7	8	11	0	5	4	0
5	8	7	8	7	8	11	0	5	4	0
Pinyon-Juniper Fuelwood (MMBF)										
Decade 1	9	5	10	8	9	5	0	5	6	15
2	9	5	10	8	9	5	0	5	6	15
3	9	5	10	8	9	5	0	5	6	15
4	9	5	10	8	9	5	0	6	7	15
5	9	5	10	8	9	5	0	6	7	15
Water Yield (MAcFt)										
Decade 1	302	303	303	303	303	302	294	303	303	303
2	301	301	303	300	301	303	285	302	302	311
3	300	301	303	298	300	305	279	308	305	317
4	299	300	301	295	299	305	273	308	309	319
5	303	302	304	299	305	311	268	309	310	321

ECONOMIC FACTORS

Alternative Costs

Table 30 displays the average annual cost to implement the various alternatives and benchmarks for the first five decades. The costs are in thousands of 1982 dollars. Costs are broken down into major budgetary components, including operation and maintenance (O&M), capital investment, purchaser credit roads, and fire fighting. The total constrained Forest Service budget and the total costs are also displayed.

The benchmarks are included so the alternatives can be viewed in perspective. The benchmarks do not contain all the constraints that were applied to the alternatives to make them financially and legally feasible.

Table 30. Average Annual Maintenance and Investment Costs by Alternatives & Selected Benchmarks

	Alternatives						Benchmarks			
Activity	PA	A	B	C	D	E	Min Level	Max PNV Assigned	Max Timber	Max Range
						M DOLLARS				
O&M except Roads										
Decade 1	3670	3503	3789	3672	3874	3220	1134	3443	3693	4181
2	3703	3529	3928	3664	3982	3258	1134	3492	3767	4357
3	3750	3543	3980	3691	4039	3330	1134	3536	3816	4412
4	3767	3549	3994	3697	4057	3300	1134	3545	3727	4329
5	3771	3549	2974	3741	4061	3300	1134	3545	3827	4429
O&M Roads										
Decade 1	257	250	275	254	259	224	237	239	264	317
2	257	250	275	254	259	224	237	239	264	317
3	257	250	275	254	259	224	237	239	264	317
4	257	250	275	254	259	224	237	239	264	317
5	257	250	275	254	259	224	237	239	264	317
Capital Investment without Roads										
Decade 1	3769	3145	3568	3414	3552	4376	40	4882	5249	8136
2	3569	3154	3431	3144	3437	4180	40	4176	4497	5864
3	3498	4671	3704	3160	4014	3897	40	4055	4412	4796
4	3468	4306	4184	3303	3902	4071	40	4209	4430	4395
5	3537	4529	4708	3264	4114	3957	40	4000	4231	3699

Table 30 (cont) Average Annual Maintenance and Investment Costs by Alternatives & Selected Benchmarks

Activity		Alternatives PA	A	B	C	D	E	Benchmarks Min Level	Max PNV Assigned	Max Timber	Max Range
						M DOLLARS					
Capital Investment/Roads											
Decade	1	406	368	469	387	420	281	0	337	435	660
	2	406	368	469	387	420	281	0	337	435	660
	3	406	368	469	387	420	281	0	337	435	660
	4	406	368	469	387	420	281	0	337	435	660
	5	406	368	469	387	420	281	0	337	435	660
Forest Service Budget 1/											
Decade	1	8102	7266	8101	7727	8105	8101	1411	8901	9641	13294
	2	7935	7301	8103	7449	8098	7943	1411	8244	8963	11198
	3	7911	8832	8428	7492	8732	7732	1411	8167	8927	10185
	4	7898	8473	8922	7641	8638	7876	1411	8330	8856	9701
	5	7971	8696	8424	7646	8854	7782	1411	8121	8757	9305
Purchaser Road Construction											
Decade	1	141	140	146	129	133	192	0	217	231	412
	2	127	160	130	110	106	188	0	185	195	242
	3	133	172	158	115	151	164	0	165	183	216
	4	142	208	184	141	183	183	0	185	204	263
	5	115	206	209	125	160	178	0	176	186	196
Firefighting Fund											
Decade	1	469	427	421	446	372	561	148	501	382	275
	2	469	427	421	446	372	561	148	501	382	275
	3	469	427	421	446	372	561	148	501	382	275
	4	469	427	421	446	372	561	148	501	382	275
	5	469	427	421	446	372	561	148	501	382	275
Total Forest Costs 1/											
Decade	1	8712	7833	8668	8302	8610	8854	1559	9619	10254	13981
	2	8531	7888	8654	8005	8576	8692	1559	8930	9540	11715
	3	8513	9431	9007	8053	9255	8457	1559	8833	9492	10676
	4	8509	9108	9527	8228	9193	8620	1559	9016	9442	10239
	5	8555	9329	9054	8217	9386	8501	1559	8798	9325	9776
Non-Forest Service Costs 1/											
Decade	1	265	72	154	199	318	183	0	153	153	155
	2	454	87	678	213	366	706	0	678	679	679
	3	159	87	1223	47	1209	1209	0	1223	1224	1224
	4	1128	87	290	48	176	316	0	289	390	390
	5	128	87	184	1238	176	210	0	183	184	184
Total Costs											
Decade	1	8977	7905	8822	8501	8928	9037	1559	9772	10407	14136
	2	8985	7975	9332	8218	8942	9398	1559	9608	10219	12394
	3	8672	9518	10230	8100	10464	9666	1559	10056	10716	11900
	4	9637	9195	9817	8276	9369	8936	1559	9305	9832	10629
	5	8683	9416	9238	9455	9562	8711	1559	8981	9509	9960

1/ The cost of alternatives is displayed incrementally. The constrained Forest Service budget includes the costs that are subject to budget constraints and include normal appropriations. Total Forest costs include purchaser road construction funds and firefighting funds in addition to the constrained budget. Total costs include non-Forest Service costs such as private sector recreation investments and range permittee costs.

Discussion

The Minimum Level benchmark defines the least costs program for keeping the Forest in public ownership. It provides for protection of soil and water resources and productivity of the land. It also provides for the protection of life, health and safety of the incidental user, the prevention of environmental damage to adjoining lands, and the administration of established special uses and minerals. The purpose is to identify naturally occurring outputs that are harvested without direct management actions with any direct costs.

The Maximum PNV Assigned Value benchmark represents the most cost efficient method of managing the forest based on resources having an established market or assigned value and the associated costs of producing those resource outputs. These, along with the Maximum Range and Maximum Timber benchmarks, are included for comparative purposes.

Alternative A displays the consequences of continuing with the current management direction. This is important because it establishes a baseline from which to compare the effect of analyzing other combinations of management prescriptions to attain specific resource outputs or to implement specific management decisions.

In the first five decades, total sawtimber and products volume are highest for Alternatives B,D and E. This is because the objective of these alternatives is to emphasize market outputs. The remaining alternatives provide a level of timber related outputs relative to their degree of emphasis on market values.

The operation and maintenance (O&M) costs are mostly salaries and routine operations that fluctuate more with the timber program than any other single variable. The relative level of expenditures reflects an almost optimal degree of maintenance throughout the planning horizon. Of the two capital investment costs, the first includes recreation trails, and administrative building construction that level-off in the out decades as the projected demand is satisfied. In the second capital investment cost, road construction is displayed in various combinations of early/late construction programs to be in concert with the intent of the alternative. The constrained Forest Service budget costs are monies that Congress appropriates from the Treasury.

Purchaser road construction costs are directly related to road needs in the timber program. The firefighting fund is inversely related to expenditures in the appropriated forest fire protection fund based on an analysis of the effects of various budget levels for fire protection. Non-Forest Service costs include improvement work completed by the range permittee, timber purchaser equipment costs for road credit, and recreational volunteer costs. The significant budget components are funds related to fire, roads, timber, and general administration. Variations in total costs are mainly attributable to either timber or roads.

Costs

Table 31 displays the undiscounted costs of implementing the alternatives and selected benchmarks for five decades. They are expressed as average annual figures in thousands of dollars. The benchmarks were included so the alternatives can be viewed in perspective. The benchmarks do not contain all the constraints that were applied to the alternatives to make them financially nor legally feasible.

The cost breakdowns shown in table 31 reflect costs for each resource area. The purpose of the table is to show the relative differences among alternatives. It should be noted that these costs do not fully reflect the true production cost for an individual resource. In other words, the joint costs of production are not fully accounted for when using these kinds of cost breakdowns. For example, the cost shown for the "sawtimber" category does not reflect the fact that some of the dollars spent actually contribute to the production of other outputs such as grazing, increased water yield, and others. Almost all of the cost categories shown involve some degree of joint costs such as in the above example. Because of this, some caution should be exercised in the interpretation of these costs. To be strictly correct, each alternative must be evaluated based upon the total cost of the alternative, rather than any single cost category.

Table 31. Average Annual Cost by Resource Element-Thousand Jan. 1, 1982 Dollars

	Alternatives						Benchmarks			
Resource Activity	PA	A	B	C	D	E	Min Level	Max PNV Assigned	Max Timber	Max Range
FS Developed Rec										
Decade 1	268	224	179	280	220	141	105	178	178	178
2	278	224	232	280	241	227	105	265	265	265
3	312	224	285	252	292	245	105	286	286	286
4	355	224	248	252	282	210	105	249	249	249
5	330	224	248	385	282	210	105	249	249	249

Table 31 [cont], Average Annual Cost by Resource Element-Thousand Jan, 1, 1982 Dollars

Resource Activity		Alternatives PA	A	B	C	D	E	Benchmarks Min Level	Max PNV Assigned	Max Timber	Max Range
Pvt Developed Rec (Non-Forest Service Costs)											
Decade	1	228	34	115	166	280	146	0	115	115	115
	2	402	34	625	166	310	655	0	626	626	626
	3	107	34	1171	0	1159	1199	0	1171	1171	1171
	4	1072	34	237	0	124	266	0	237	237	237
	5	72	34	131	1190	124	160	0	131	131	131
Dispersed Rec Costs											
Decade	1	209	150	207	203	167	173	46	186	200	180
	2	186	150	181	183	148	157	46	164	175	167
	3	183	150	177	176	148	154	46	161	172	159
	4	183	150	178	176	148	154	46	161	172	159
	5	183	150	178	176	148	154	46	161	172	159
Wilderness											
Decade	1	15	1	15	38	15	15	3	15	3	15
	2	12	1	12	22	12	12	3	12	3	12
	3	12	1	12	22	12	12	3	12	3	12
	4	12	1	12	22	12	12	3	12	3	12
	5	12	1	12	23	12	12	3	12	3	12
Wildlife											
Decade	1	479	100	298	378	282	296	53	315	327	447
	2	479	100	298	378	282	296	53	315	327	447
	3	479	100	298	378	282	296	53	315	327	447
	4	479	100	298	378	282	296	53	315	327	447
	5	479	100	298	378	282	296	53	315	327	447
Range											
Decade	1	461	451	571	419	561	415	27	445	468	599
	2	476	467	685	426	690	395	27	453	493	743
	3	475	467	694	426	700	388	27	449	495	757
	4	474	467	694	426	700	385	27	448	494	757
	5	474	467	694	426	700	385	27	448	494	757
Sawtimber, Products											
Decade	1	2926	2750	2847	2658	2835	3925	0	4386	4656	7448
	2	2896	2936	2805	2556	2821	3828	0	3759	4000	5114
	3	2845	4479	3127	2623	3429	3555	0	3649	3930	4039
	4	2771	4130	3650	2761	3345	3764	0	3839	3980	3709
	5	2843	4351	3184	2637	3538	3645	0	3621	3763	3146
Commercial Fuelwood (Timber Sale)											
Decade	1	3	21	20	0	18	4	0	3	0	36
	2	3	21	20	0	18	4	0	3	0	36
	3	3	21	20	0	18	4	0	3	0	36
	4	3	21	20	0	18	4	0	3	0	36
	5	3	21	20	0	18	4	0	3	0	36
Soil and Water											
Decade	1	159	121	163	194	148	139	0	156	191	146
	2	159	121	163	194	148	139	0	156	191	146
	3	159	121	163	194	148	139	0	156	191	146
	4	165	121	170	206	155	141	0	158	202	149
	5	165	121	170	206	155	141	0	158	202	149
Minerals											
Decade	1	75	70	89	72	91	70	0	72	81	95
	2	75	70	92	72	94	71	0	72	82	99
	3	76	70	95	73	97	71	0	72	83	103
	4	76	70	96	73	98	71	0	72	83	104
	5	76	70	96	73	99	71	0	72	83	104

Table 31 (cont). Average Annual Cost by Resource Element-Thousand Jan. 1, 1982 Dollars

Resource Activity		Alternatives PA	A	B	C	D	E	Benchmarks Min Level	Max PNV Assigned	Max Timber	Max Range
Fire											
Decade	1	1863	1768	1935	1842	1990	1810	323	1837	1867	2131
	2	1863	1768	1935	1842	1990	1810	323	1837	1867	2131
	3	1863	1768	1935	1837	1990	1810	323	1837	1867	2131
	4	1863	1768	1935	1837	1990	1810	323	1837	1867	2131
	5	1863	1768	1935	1837	1990	1810	323	1837	1867	2131
Roads, FA and O											
Decade	1	1164	1059	1196	1082	1120	854	134	964	1136	1446
	2	971	926	1062	949	987	748	134	846	1005	1308
	3	971	926	1064	949	987	744	134	845	1006	1313
	4	997	952	1090	975	1013	774	134	874	1033	1339
	5	997	952	1090	975	1013	774	134	874	1033	1339
Other											
Decade	1	1187	1152	1188	1169	1201	1048	647	1100	1185	1300
	2	1187	1152	1188	1169	1201	1048	647	1100	1185	1300
	3	1187	1152	1188	1169	1201	1048	647	1100	1185	1300
	4	1187	1152	1188	1169	1201	1048	647	1100	1185	1300
	5	1187	1152	1188	1169	1201	1048	647	1100	1185	1300
Total Cost											
Decade	1	8977	7905	8822	8501	8928	9037	1338	9772	10407	14136
	2	8985	7975	9332	8218	8942	9398	1338	9608	10219	12394
	3	8672	9518	10230	8100	10464	9666	1338	10056	10716	11900
	4	9637	9195	9817	8276	9369	8936	1338	9305	9832	10629
	5	8683	9416	9238	9455	9562	8711	1338	8981	9509	9960

Discussion

Costs to implement the alternatives very only slightly. O&M costs are similar. In an effort to accomplish the target levels set by the regional guide, the RPA road O&M costs are higher. Capital investments are higher for alternatives that emphasize commodity production, due to the assigned benefits received from the developed recreation areas. Costs are stated in 1980 fourth-quarter dollars.

Benefits

Table 32 shows the average annual resource benefits for the major resources having benefit values for the alternatives and selected benchmarks. The values displayed are undiscounted benefits for each of the first five ten-year time periods. These data are useful to evaluate trends over time in resource production and value. Table 32 also contains data on receipts to the U.S. Treasury, and distribution of revenues to the state, by alternative.

Table 32. Average Annual Benefits-Thousand Jan. 1, 1982 Dollars

Resource Activity		Alternatives PA	A	B	C	D	E	Benchmarks Min Level	Max PNV Assigned	Max Timber	Max Range
Public Sector Developed Rec Use-STD											
Decade	1	2974	909	1070	3314	2045	540	0	1070	1070	1070
	2	3011	842	1780	3438	2405	1212	0	1780	1780	1780
	3	3135	0	2528	3438	3153	1960	0	2528	2528	2528
	4	3883	0	2547	3438	3276	1969	0	2547	2547	2547
	5	3949	0	2566	4318	3333	1979	0	2566	2566	2566
Public Sector Developed Rec Use-LSTD											
Decade	1	0	1092	0	0	0	0	0	0	0	0
	2	0	1102	0	0	0	0	0	0	0	0
	3	0	1548	0	0	0	0	0	0	0	0
	4	0	1548	0	0	0	0	0	0	0	0
	5	0	1548	0	0	0	0	0	0	0	0

Table 32 [cont], Average Annual Benefits-Thousand Jan, 1, 1982 Dollars

Resource Activity		Alternatives						Benchmarks			
		PA	A	B	C	D	E	Min Level	Max PNV Assigned	Max Timber	Max Range
Private Sector Developed Rec											
Decade	1	2614	2611	2555	2225	3541	5049	0	4555	4555	4555
	2	3873	2244	5899	3200	4820	6458	0	5899	5899	5899
	3	5227	2253	7130	4015	6174	7661	0	7130	7130	7130
	4	5360	2253	7992	4147	6316	7670	0	7922	7992	7992
	5	5360	2253	7992	5369	6316	7679	0	7992	7992	7992
Dispersed Rec Use -STD											
Decade	1	2982	0	2971	2983	2065	2504	0	2731	2963	2283
	2	3415	0	3384	3383	2320	2856	0	3098	3366	2634
	3	3804	0	3775	3759	2576	3185	0	3451	3751	2961
	4	4172	0	4138	4122	2823	3495	0	3784	4114	3249
Dispersed Rec Use-LSTD											
Decade	1	0	1445	6	0	357	118	764	63	8	273
	2	0	1691	6	0	402	133	764	72	9	307
	3	3	1796	7	3	446	150	764	82	10	342
	4	4	1971	7	3	489	165	764	89	11	377
	5	4	2149	8	3	532	180	764	97	12	410
Dispersed Highway Rec Use											
Decade	1	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820
	2	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820
	3	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820
	4	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820
	5	3820	3820	3820	3820	3820	3820	3820	3820	3820	3820
Wilderness Use-STD											
Decade	1	96	0	96	96	96	96	0	96	14	96
	2	110	0	110	110	110	110	0	110	28	110
	3	124	0	124	124	124	124	0	124	28	124
	4	138	0	138	138	138	138	0	138	28	138
	5	151	0	151	151	151	151	0	151	28	151
Wilderness Use-LSTD											
Decade	1	0	22	0	0	0	0	12	0	15	0
	2	0	29	0	0	0	0	22	0	22	0
	3	0	29	0	0	0	0	22	0	22	0
	4	0	36	0	0	0	0	22	0	22	0
	5	0	36	0	0	0	0	29	0	29	0
Wildlife Rec Use											
Decade	1	4887	4725	4698	5130	4725	4860	4644	4806	4725	4725
	2	4833	4671	4725	4995	4725	4860	4617	4806	4671	4779
	3	4806	4644	4752	4887	4725	4833	4563	4806	4644	4806
	4	4752	4590	4725	4752	4725	4833	4536	4806	4590	4860
	5	4725	4563	4779	4644	4725	4833	4482	4806	4563	4914
Grazing Capacity											
Decade	1	724	734	765	651	734	713	0	734	734	776
	2	755	755	827	672	796	713	0	745	755	838
	3	755	776	889	672	869	713	0	755	786	920
	4	755	776	920	672	900	703	0	744	786	951
	5	755	776	962	672	941	693	0	744	786	1003
Sawtimber											
Decade	1	7067	6501	6861	6419	6825	9954	0	11205	11424	17524
	2	8523	7503	8138	7444	8855	12156	0	12061	11977	16793
	3	7679	11314	8558	7106	9643	9816	0	10012	11181	11362
	4	6931	9933	8697	7120	8952	10315	0	10271	10205	8793
	5	7806	10417	8376	6815	8380	9369	0	9328	10526	6712

Table 32 [cont]. Average Annual Benefits-Thousand Jan. 1, 1982 Dollars

Resource Activity		Alternatives PA	A	B	C	D	E	Benchmarks Min Level	Max PNV Assigned	Max Timber	Max Range
All Pinyon-juniper Fuelwood											
Decade	1	70	39	80	62	70	39	0	39	47	116
	2	70	39	80	62	70	39	0	39	47	116
	3	70	39	80	62	70	39	0	39	47	116
	4	80	39	80	62	70	39	0	39	54	116
	5	80	39	80	62	70	39	0	39	54	116
Water Yield											
Decade	1	13137	13181	13181	13181	13181	13137	12789	13181	13181	13181
	2	13094	13094	13181	13050	13094	13181	12397	13137	13137	13529
	3	13050	13094	13181	12963	13050	13268	12136	13398	13268	13790
	4	13007	13050	13094	12833	13007	13268	11875	13398	13442	13877
	5	13181	13137	13224	12833	13268	13529	11658	13442	13485	13964
Wild Burro Use											
Decade	1	5	5	5	5	5	5	5	5	5	5
	2	5	5	5	5	5	5	5	5	5	5
	3	5	5	5	5	5	5	5	5	5	5
	4	5	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5	5	5
Total Receipts (MDollars)											
Decade	1	7664	6996	7353	7018	7333	10346	0	11644	11874	18094
	2	9271	8056	8805	8171	9492	12696	0	12663	12504	17489
	3	8466	11706	9360	7839	10386	10518	0	10772	11906	12199
	4	7816	10328	9552	7856	9696	11024	0	11058	11021	9697
	5	8676	10799	9237	7679	9129	10075	0	10105	11332	7621
Distribution to Counties (MDollars)											
Decade	1	1916	1749	1838	1755	1833	2587	0	2911	2969	4524
	2	2318	2014	2201	2043	2373	3174	0	3166	3126	4372
	3	2117	2927	2340	1960	2597	2630	0	2693	2977	3050
	4	1654	2582	2388	1964	2424	2756	0	2765	2755	2424
	5	2169	2700	2309	1920	2282	2519	0	2526	2833	1905

Discussion

Federal government receipts attributable to Forest activities in Table 32 are for timber, range, and developed recreation. Receipts are not collected for water, dispersed recreation, wilderness or wildlife. Mineral royalties and lease payments are administered by the Bureau of Land Management (BLM). Government receipts for grazing and recreation are considerably less than the benefit values used in FORPLAN. This is because of the difference between "willingness to pay" (benefit values) and actual payments (receipts). Timber receipts are slightly less than timber benefits because dead and down fuelwood actual receipts are less than modeled benefits. Range receipts, $2.00 per animal-month (AM) (1985 fee), are considerably less than modeled benefit values. Recreation values reflect actual receipts based on specific levels of management.

Each year the Forest Service returns 25 percent of the gross revenue to the states for disbursements to counties based on the percentage of the national forest acreage in the county. The counties within the Kaibab National Forest area of influence include Coconino, Yavapai, and Mohave.

Changes in market prices and willingness to purchase by the private sector can cause widely fluctuating revenues.

Due to the high timber outputs, decade 1 local government receipts would be greatest in Alternative E, followed by Alternatives PA, B, D, and C. For the total of decades one through five, receipts are greatest in Alternatives E and A. Generally, increased receipts and taxes force higher maintenance costs. In Alternative E, receipts are greatest, but probably so are government costs from greater forest user demands, road wear, increasing population requirements for expanded government services as schools and sanitation, and more maintenance for existing facilities. The inverse situation holds for decreasing government receipts and taxes.

Counties also receive payments in lieu of taxes. This program is administered by the Department of Interior, BLM. The program is dependent on annual congressional appropriations rather than forest receipts, and therefore, the payment program is not included in the analysis.

Difference In Cash Flow

While comparisons of economic benefits to budget costs are necessary to determine the economic efficiency of alternatives, cash receipts and net cash flows to the U.S. Treasury and to the taxpayers are also important. Receipts from national forest lands are generated from timber sales, grazing fees, recreation user fees, land-use fees, and mineral sales and leases. Mineral royalties collected by the BLM are not included in these receipt estimates. It is assumed that royalty payments would not change in any alternative. Estimated average annual receipts, budget costs, and net cash receipts for time periods 1 and 5 are displayed in the following table.

Table 33. Comparison of Receipts, 1/ Costs, 2/ and Net Cash Flows 3/ by Alternative and Maximum PNV for Decades 1 and 5

Decade	Alternatives						
	MAX PNV	E	A	PA	D	C	B
Decade 1							
Receipts	11644	10347	6996	7664	7333	7018	7353
Costs	9619	8854	7833	8712	8610	8302	8668
Net Flow	+2025	+1493	-837	-1048	-1277	-1284	-1315
Decade 5							
Receipts	10105	10075	10799	8676	9129	7679	9237
Costs	8798	8501	9329	8555	9386	8217	9054
Net Flow	+1307	+1574	+1470	+121	-257	-538	+183

1/ Receipts are taken from Table 32 and do not include mineral royalties collected by the BLM.

2/ Costs are total FS costs from Table 30. These costs include purchaser road construction and firefighting fund.

3/ Government receipts are estimated for timber, grazing, and recreation. These receipts normally account for about 98 percent of the total, excluding mineral royalties and lease payments.

Income Transfers

Income transfers are defined to be the difference between the full economic value of resources [the potential cash value of "benefit" value], and the fees actually paid by users of those resources. They are benefits to individual users who are charged no fees or who are charged fees that are less than full economic values. The following table displays income transfer for timber, range, recreation, wildlife, and water yield.

Discussion

As displayed in the following table, the greatest amount of income transfer is in recreation and water. The least amount is in timber and consists of the difference between fees and designated value for fuelwood, including dead and down or timber sale slash.

The following receipts include projected cash returns from developed use, and $2.00 per AM, and at assigned benefit values for timber/fuelwood MBF which includes K-V collections and timber purchaser road credits. The alternatives are presented in order of net cash flow for Decade 1. As calculated, generally receipts are comprised of 95 percent timber, three percent range, and two percent developed recreation. Because timber comprises virtually all receipts, the cash flow is an emulation of the timber program in each alternative.

Table 34. Economic Comparisons by Alternative and Maximum PNV for Resource Element
Average Annual Income Transfers - Decade 1 - Thousand 1982 Dollars

		Alternatives					
Resource Element 1/	MAX PNV	E	A	PA	D	C	B
Timber Benefits	11246	9995	6542	7140	6901	6485	6947
Timber Receipts 2/	11246	9995	6542	7140	6901	6458	6947
Income Transfer	0	0	0	0	0	0	0
Range Benefits	734	713	734	724	734	651	765
Range Receipts	154	152	156	156	154	140	162
Income Transfer	580	561	578	568	580	511	603
Recreation Benefits	12335	12172	9349	12486	11924	12438	10518
Recreation Receipts	244	200	298	368	278	393	244
Income Transfer	12091	11972	9051	12118	11646	12045	10274
Wildlife Benefits	4806	4806	4725	4887	4725	5130	4698
Wildlife Receipts	0	0	0	0	0	0	0
Income Transfer	4806	4806	4725	4887	4725	5130	4698
Water Benefits	13181	13137	13181	13137	13181	13181	13181
Water Receipts	0	0	0	0	0	0	0
Income Transfer	13181	13137	13181	13137	13181	13181	13181

1/ Benefits are taken from Table 32.

2/ Receipt totals are shown in Table 32. See Appendix B for procedure to estimate receipts. Government receipts are estimates for timber, grazing, and recreation. These receipts normally account for about 98 percent of the total, excluding mineral royalties and lease payments.

Present Net Value Analysis

Present net value (PNV) of priced benefits was the method used to solve the optimization problem modeled in the benchmarks and alternatives. The priced outputs are those that are or can be exchanged in the marketplace or for which "willingness to pay" values have been assigned. These include wildlife, wilderness, developed and dispersed use, permitted livestock use, timber products and fuelwood, minerals and water yield.

The alternatives are designed and analyzed to achieve goals and objectives for priced outputs in a manner that achieves the greatest excess in the value of priced outputs in relation to cost of production while meeting all specified constraints and objectives. The alternatives are also designed to achieve any specified non-priced outputs or benefits and to meet constraints at least cost. The PNV of each alternative, therefore, estimates the value of the maximum attainable net benefits of priced outputs the market value of resources after all costs of producing outputs and meeting constraints have been subtracted from the value of the expected flow of priced outputs.

The following table displays the alternatives arranged in order of decreasing present net value of benefits (PVB). The intent is to display what happens to PNV as PVB decreases marginally from one alternative to the next. It is important to note the alternatives were not developed in order of decreasing costs but are displayed in this fashion to provide a comparative analysis.

Table 35, Value Analysis by Alternative-Millions Jan. 1, 1982 Dollars

	Alternative						
	PNV	E	B	PA	D	C	A
PVB	1144.3	1128.0	1076.8	1047.9	1054.1	1020.7	939.2
CHANGE Betw. Alt.		-16.3	-51.2	-28.9	+6.2	-33.4	-81.5
PVC	242.2	231.3	236.1	226.5	236.4	216.7	218.1
CHANGE Betw. Alt.		-10.9	+4.8	-9.6	+9.9	-19.7	+1.4
PNV	902.1	896.7	840.7	821.4	817.7	804.0	721.1
CHANGE Betw. Alt.		-5.4	-56.0	-19.3	-3.7	-13.7	-82.9
B/C	4.72	4.88	4.56	4.63	4.46	4.71	4.31

	Alternative						
PVB by Resource Category	PNV	E	B	PA	D	C	A
Developed Recreation	206.8	206.3	206.8	187.9	195.4	181.4	107.7
Dispersed Recreation	182.7	177.6	188.5	189.1	170.6	188.2	140.7
Wilderness	2.9	2.9	2.9	3.1	2.9	2.9	.8
Wildlife	121.7	122.7	119.8	121.9	119.6	124.7	117.7
Range	18.9	18.1	21.7	18.9	21.2	17.0	19.3
Sawtimber/Products	272.0	261.8	200.1	192.9	208.4	174.8	217.7
Fuelwood	1.0	1.0	2.0	1.9	1.8	1.8	1.0
Water Yield	338.3	337.6	335.0	332.2	334.2	330.1	334.3
PVC by Major Budget Cost Category							
Developed Recreation	16.0	15.9	16.0	15.2	15.7	15.8	6.6
Dispersed Recreation	4.2	4.1	4.7	4.9	4.0	4.7	3.8
Wilderness	.3	.3	.3	.3	.3	.7	.1
Wildlife	8.0	7.5	7.5	12.1	7.1	9.6	2.5
Range	11.4	10.1	16.6	11.9	16.5	10.7	11.8
Sawtimber/Products	99.4	95.6	76.7	72.8	79.0	66.7	89.1
Fuelwood	.1	.1	.5	.1	.5	.1	.5
Soil/Water	4.0	3.5	4.1	4.1	3.8	5.0	3.1
Fire	46.5	45.8	49.0	47.2	50.4	46.6	44.8
Roads/FAO	22.6	20.1	28.2	25.9	26.3	25.4	24.7
Other	28.7	28.3	32.5	32.0	32.8	31.4	31.1

Present values for resource benefits (PVB) and associated discounted costs (PVC) are shown in Table 35 above. Benefit values for timber include market values (revenues) for sawtimber and products. Fuelwood is displayed as a separate category and includes accessible fuelwood. Recreation benefits include separate categories for developed recreation and dispersed recreation, wildlife and fish user days, and wilderness recreation. Range values consist of the total value of all permitted AUM's. The water yield benefit is based on the assigned value of an acre-foot of water. Only the incremental increase or decrease in water yield from the existing level is valued.

The present value for timber costs (PVC) include funds necessary to administer the timber program on the forest. The individual cost items tracked in FORPLAN are shown in Appendix B. The costs for recreation and wildlife, range, protection, roads and facilities, and all other costs are costs necessary to administer the respective programs. All benefits and costs identified are those that appear in the FORPLAN model.

In general, decreasing budget costs result in decreased benefits and PNV. The relative magnitude varies depending on whether commodity or amenity outputs are being emphasized.

It must be remembered that dispersed recreation, wilderness, and wildlife benefits do not result in actual returns to the U. S. Treasury. As a result, receipts to the U. S. Treasury and payments to counties in lieu of taxes are significantly higher for the commodity emphasis alternatives. The effect on PNV from one alternative to the next in the table above fluctuates as per the discussion for benefits - the PNV

is generally higher for the non-commodity emphasis alternatives than for the commodity emphasis alternatives. The primary determinant of the magnitude of benefits in each alternative is the level of dispersed and developed recreation and the timber harvest level. The benefit/cost ratio is highest for Alternative E due to a strong mix of these resources.

Non-priced Benefits

Non-priced benefits include on-site outputs or effects. Non-priced benefits are those benefits for which no monetary value or price can be determined. Examples can include: impacts on local employment, cultural resources, visual quality, watershed condition, threatened and endangered species, reduction in soil loss, riparian area rehabilitation, fire protection/suppression, and right-of-way acquisition, public health and safety, road obliteration, and old-growth habitat.

Non-priced benefits do not significantly affect priced benefits in any of the alternatives. The majority of the changes to costs in the alternatives can be tied directly to priced benefits. This, however, does not suggest that priced benefits do not significantly affect non-priced benefits or that non-priced benefits are not an important aspect of the decision making process of the Kaibab planning effort. A discussion of non-priced benefits is necessary because of their contribution to net public benefits, however, there is a difficulty in comparing trade-offs. A determination as to whether a reduction in soil loss is worth more than an increase in timber harvest becomes a judgement based on values and priorities. Present net value does not always decrease as non-priced benefits increase since non-priced benefits are often closely tied to the priced benefits as complementary. On the other hand, soil loss is directly related to road construction and timber harvest yet it has a negative benefit. Large amounts of soil loss can reduce the productivity of a site to produce vegetation which can result in secondary impacts. There is likely a trade-off relationship between soil loss and PNV. The benefit of reducing soil loss is related to the opportunity cost of reducing the volume of timber harvested.

In analyzing the trade-offs among alternatives, it is necessary to consider the entire array of non-priced benefits; the relationships between priced and non-priced benefit output levels; and the qualitative values associated with non-priced benefits as they relate to the quantitative measure of economic efficiency represented by PNV. The judgmental comparisons of alternatives performed within this framework form the principal indicator of the net public benefit associated with each alternative.

Non-priced benefits which are complementary to priced benefits include desirable distributive effects. These decrease as the priced benefits decline. The most significant measure of non-priced distributive benefits is the level of local employment associated with each alternative. The IMPLAN model will be used to evaluate the distributive effects by alternative. Results will be displayed in chapter 4 under economic and social consideration.

Present Net Value Trade-Offs

Table 36 displays the ranking of the alternatives against the Max PNV Assigned Value benchmark. The alternatives are ranked in order of decreasing PNV from left to right. The comparisons are in millions of dollars (January 1, 1982 value) discounted at four percent. The difference in PNV between alternatives is called the trade-off or opportunity cost, which is the investment opportunity foregone by implementing the alternative instead of the maximum PNV benchmark. The following discussion highlights the major opportunity costs of each alternative when compared to the alternative with the next highest PNV.

Table 36. Comparison of Alternatives with Max PNV Assigned Benchmark by Alternative and Max PNV

	MAX PNV Assigned	E	B	PA	D	C	A
PNV (MM$)	902.1	896.7	840.7	821.4	817.7	804.0	721.1
Percent of MAX PNV Assigned	100.0	99.4	93.2	91.1	90.6	89.1	79.9

Max PNV Assigned Benchmark

The objective of the Max PNV Assigned Benchmark is to maximize the present net value (PNV) of outputs with market monetary values and assigned monetary values. With the exception of the constraints common to each alternative (non-declining yield, ending inventory, long-run sustained yield, culmination of mean annual increment, and minimum management requirement) no additional constraints were placed on this benchmark to achieve certain management practices, address issues, retain existing programs, or achieve quality levels. Refer to Appendix B for a complete discussion of constraints applied to all benchmarks and alternatives. The PNV of this benchmark is used as a reference point for evaluating the opportunity costs of achieving the objectives of the alternatives. This benchmark produced the highest PNV of all benchmarks and alternatives because the sole objective of the benchmark was to maximize economic efficiency with the least number or resource constraints. The most economically efficient combination of outputs and costs resulted.

Output levels in any benchmark or alternative which exceed the Max PNV benchmark cause a situation where costs of producing the output exceed the benefits.

Alternative E

The objective of Alternative E is to maximize PNV within the $8.1 million per year budget constraint applied to all other alternatives. The purpose was to evaluate the effect of the budget constraint on outputs and PNV. The budget constraint was needed to make the alternatives comparable and to keep them within estimated budget expectations. The opportunity cost between the Max PNV Benchmark (BM 4) and Alternative E is about $5.4 million. With limited funds, timber and grazing outputs are reduced and the proportion of dispersed recreation managed at less that standard service level increases. Developed recreation use remains nearly the same. This indicates that recreation outputs are a better buy that timber and grazing outputs and can compete for limited funds.

Alternative B

The objectives of Alternative B are to produce the RPA targets assigned to the Forest in the Regional Guide within the annual $8.1 million budget constraint. The opportunity cost between Alternative E and Alternative B is about $56 million.

The $56 million decrease in PNV between Alternative E and Alternative B is caused by reductions in timber and grazing benefits. The Regional Guide timber target is about 32 percent lower than the Max PNV harvest level. Since timber output is cost efficient to produce up to the Max PNV level, timber output levels less that that in the Max PNV benchmark cause a reduction in net timber benefits and a corresponding decrease in PNV. Grazing targets, on the other hand, are higher than the Max PNV level and cause a decrease in net grazing benefits because outputs above the Max PNV level cost more than they return in benefits.

Alternative PA

The objectives of the PA Alternative are to improve land productivity and protect resource values while providing moderate increases from current levels of timber (North Kaibab Ranger District), fuelwood, and recreation outputs to resolve identified issues. The budget was limited to $8.1 million annually. The opportunity cost of Alternative PA is about $19.3 million when compared to Alternative B.

The decrease in PNV was caused primarily from a ten percent reduction in net developed recreation benefits. The reduction in net developed recreation benefits was because the present mix of public and private recreation sites was maintained and public investment in new sites was deferred to stay within the budget constraint. The deferment of new public investment and the limitation on the proportion of recreation opportunity provided by private investment reduced the recreation output and the net benefits.

A small part of the opportunity cost is caused by a reduction in timber output. Net timber benefits are reduced about three percent because an upper limit was placed on timber volume. The upper limit on the North Kaibab Ranger District was needed to balance existing mill needs with optimum wildlife habitat needs.

Alternative D

The objectives of Alternative D are to intensively manage the Forest for commodities having market values. These emphasized commodities were timber, grazing, and developed recreation. The budget was limited to $8.1 million per year consistent with the other alternatives. The opportunity cost of Alternative D is about $3.7 million when compared to Alternative PA.

The reduction in PNV is mainly caused by a reduction in total dispersed recreation output and management of a higher portion of the dispersed recreation at less than standard service level which results in a ten percent reduction in net dispersed recreation benefits.

There is also a 33 percent reduction in net grazing benefits because grazing outputs are produced above the economically efficient level. The emphasis of the alternative is on a grazing output production rather than economic efficiency.

The reductions in net dispersed recreation benefits and net grazing benefits are partially offset by increased net benefits from timber, wildlife, and developed recreation.

Alternative C

The objectives of Alternative C are to emphasize non-commodity outputs such as dispersed recreation, cultural resources, wildlife, wilderness recreation, and satisfactory watershed condition. The budget level was limited to $8.1 million per year compared to Alternative D.

The reduction in PNV is mainly caused by reductions in developed recreation and timber net benefits. Developed recreation net benefits decrease about 8 percent. This reduction is caused by an objective similar to Alternative PA to maintain the present mix of private and public sector recreation sites. Also, part of the developed recreation is managed at the less than standard service level reducing the net benefits.

Net timber benefits decrease about sixteen percent. This reduction was caused by an objective to limit timber harvest to no more than previous harvest levels and to achieve minimum old-growth objectives.

The reductions in developed recreation and timber offset by a ten percent increase in net dispersed recreation benefits.

Also, soil and water costs were higher in Alternative C than any other alternative. These costs are for increased watershed improvement projects to accelerate improvement of watershed conditions.

Alternative A

The objective of Alternative A is to project the effects of continuing current management into the future. The budget was limited to $7.3 million and limited to current management prescriptions. The opportunity cost of Alternative A is about $82.9 million when compared to Alternative C.

The reduction in PNV is caused by reductions in net developed and dispersed recreation benefits. Net developed recreation benefits are reduced about 39 percent and net dispersed recreation benefits are reduced about 25 percent. These reductions are because all recreation use is managed at less than standard service levels which have significantly lower benefit values. Also, Alternative A provides no new recreation site development and consequently produces less total recreation output than any other alternative.

A nineteen percent increase in net timber benefits partially offset the reduction caused by recreation.

The limitation to use only current management prescriptions also prevented selection of more economically efficient prescriptions. This also contributed to the reduction in PNV.

Irretrievable Commitment

Irretrievable resource commitments result from allocation decisions that reduce production or use of renewable resources. Irretrievable commitments represent opportunities foregone for the period the Forest Plan is in effect and reflect trade-offs made to integrate multiple-use considerations or to meet budget limitations. Significant irretrievable effects are summarized in Table 37. This table shows the calculation of the irretrievable effect as the difference between the highest output of any alternative and the output of each of the alternatives.

Table 37. Average Annual Irretrievable Resource Commitment in the First Decade By Alternative

	PA	A	B	C	D	E
DEVELOPED RECR.(MRVD)						
High Output	594.9	594.9	594.9	594.9	594.9	594.9
Output of Altern.	589.9	537.0	594.9	584.9	589.8	594.9
Irretrievable Comm.	5.0	57.9	0.0	10.0	5.1	0.0
DISPERSED RECR.(MRVD)						
High Output	279.2	279.2	279.2	279.2	279.2	279.2
Output of Altern.	279.2	254.8	278.7	279.2	255.3	254.3
Irretrievable Comm.	0.0	24.4	0.5	0.0	23.9	24.9
WILDERNESS USE (MRVD)						
High Output	7.4	7.4	7.4	7.4	7.4	7.4
Output of Altern.	7.4	3.7	7.4	7.4	7.4	7.4
Irretrievable Comm.	0.0	3.7	0.0	0.0	0.0	0.0
WILDLIFE (MWFUD)						
High Output	190	190	190	190	190	190
Output of Altern.	181	175	174	190	175	180
Irretrievable Comm.	9	15	16	0	15	10
RANGE CAPACITY (MAUM)						
High Output	74	74	74	74	74	74
Output of Altern.	70	71	74	63	71	69
Irretrievable Comm.	4	3	0	11	3	5
ALLOWABLE SALE QUANTITY (MMCF)						
High Output	19.5	19.5	19.5	19.5	19.5	19.5
Output of Altern.	14.5	12.1	14.5	13.1	13.7	19.5
Irretrievable Comm.	5.0	7.4	5.0	6.4	5.8	0.0
PINYON-JUNIPER FUELWOOD (MMBF)						
High Output	10	10	10	10	10	10
Output of Altern.	9	5	10	8	9	5
Irretrievable Comm.	1	5	0	2	1	5
WATER YLD.(MACFT)						
High Output	302.6	302.6	302.6	302.6	302.6	302.6
Output of Altern.	302.5	302.6	302.5	302.6	302.6	302.5
Irretrievable Comm.	.1	0	.1	0	0	.1

SUMMARY OF SIGNIFICANT EFFECTS

Developed Recreation - All Alternatives except Alternative A provide adequate developed recreation capacity to meet projected future use. Alternative A maintains a nearly even distribution between public and private sector developed facilities. Alternatives PA and C maintain the even distribution of public and private facilities in the early decades but gradually shift most of the facilities to the private sector in later decades. Alternatives B, D and E result in a dramatic shift to private sector operations by converting existing public sites to concession operations.

Developed recreation use is managed at the standard service level in Alternatives PA, B, D and E and enhance visitor experience, convenience and information. Alternatives A and C provide a portion of the developed recreation at less than standard service level, which will lower the level of visitor experience, convenience and information. Some facilities may be temporarily closed and occasional overuse may occur under less than standard service level management.

Dispersed Recreation - Alternatives PA, B and C manage nearly the entire Forest at standard service level and enhance visitor experience, convenience and information services. Alternatives A, D and E provide less than standard service level

management for portions of the Forest which reduces the level of visitor experince, convenience and information. All alternatives except Alternatives A and D provide for a 27 percent increase in acreage closed to off-road vehicles.

Wilderness - Except for Alternative A, all wilderness is managed at standard service level. Alternative C provides for regular wilderness patrols, elimination of non-conforming uses, and increased visitor contacts by Wilderness Rangers and provides the highest level of wilderness enhancement and protection. Alternatives PA, B, D and E focus management efforts in high use areas and along wilderness boundaries to protect and maintain wilderness characteristics.

Visual Resources - Alternatives PA and B manage about one-third of the Forest under the high visual management intensity level and provide the greatest degree of visual diversity. Alternatives C and D manage most of the Forest under a moderate visual management intensity level. Under alterntives PA, B, C and D, landscape diversity is enhanced in sensitive road corridors and adjacent to developed recreation sites.

Alternative E manages about one-third of the Forest under the high visual management intensity level and provides visual diversity slightly less than Alternative D.

Alternative A provides the least visual diversity by managing the entire Forest under the low visual management intensity level.

Cultural Resources - Alternatives PA, B, C, D and E increase the area of cultural resource survey and focus surveys in woodland areas which currently receive little attention. The potential for inadvertent cultural resource site damage from project activities is greatest under Alternatives PA, B, C and E which have the highest level of project activity in woodland areas.

Alternatives PA, B and C provide for cultural resource surveys in non-project areas and cultural resource site evaluations. Alternatives D and E also provide for limited non-project related survey and site evaluations.

Wildlife - Alternatives PA and C provide the highest level of diversity and interspersion of habitat. Alternatives B and D show a moderate increase in diversity of habitats and Alternatives A and E reflect a decline in diversity.

Alternatives PA and C provide high levels of increased habitat quality. Alternatives B, D, and E provide a moderate level of increased habitat quality while Alternative A results in a slight decline in habitat quality.

Alternative PA provides the best distribution of diverse habitats and benefits the greatest number of management indicator species. Alternative C supplies a balance of habitats, and increases habitat capability for those indicator species using late seral steges of pine and mixed conifer. Alternatives PA and C result in the greatest increase in habitat capability for big game. Alternatives B and D provide moderate increase in habitat capability. Alternatives A and E result in declining habitat capability.

All alternatives provide for conserving threatened and endangered species and special management areas.

Riparian Habitats - Alternatives PA and C improve riparian habitat to satisfactory condition by the second decade. Alternatives A, B, and D improve a moderate amount of the riparian areas to satisfactory condition by the second decade. Alternative E improves a smaller area of riparian habitat.

Range - Alternatives PA, A, B, and D provide positive change in management intensity level while Alternatives C, and E reflect a decrease in intensity of management.

Timber - All alternatives provide adequate commercial sawtimber, products, and total fuelwood to meet projected future use. Alternative E best addresses the criteria for the resolution of the commercial timber issue. Alternative B best addresses the criteria for the resolution of the fuelwood issue. Alternative A provides the poorest resolution of both issues.

All alternatives illustrate compromises made in silviculture and timber management, to better resolve other forest resource issues, primarily wildlife habitat and range.

Watershed - All alternatives have a positive impact on watershed condition. However, only Alternatives PA, B, C, and D improve all watersheds to satisfactory condition. Alternatives A and E provide for gradual improvement of watershed condition but do not improve all watersheds to satisfactory condition.

Lands - Budget allocations in Alternatives PA, B, C and D allow for an overall efficient lands management program. Alternatives PA, B, C, D and E almost double the amount of National Forest System lands available for exchange. The majority of this increase is adjacent to Williams, Tusayan and Parks.

Minerals - Mineral prospecting and exploration activities are restricted in Alternatives PA, C and E by seasonal closures in and adjacent to important wildlife habitats, and along visually sensitive roadside corridors. All alternatives recommend additional mineral withdrawals to protect capital investments, threatened and endangered species habitats and visually sensitive areas.

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Developed Recreation - Increased user conflicts, and deterioration and closure of some sites occurs under Alternatives A and C since some of the developed recreation use is managed at less than standard service level.

Dispersed Recreation - Less than standard management results in some deterioration of desirable settings and increased user conflicts under Alternatives A, D and E.

Soil and vegetation damage may occur in sensitive areas from unrestricted off-road vehicle use under Alternatives A and D.

Wilderness - Wilderness administration is inadequate and may degrade wilderness values under Alternative A.

Visual Quality - A gradual decline in visual diversity may occur in some sensitive areas under Alternative A.

Cultural Resources - All alternatives except Alternative A provide for increased levels of project activity in the woodland vegetation type with a corresponding risk of inadvertent cultural resource site damage.

Timber - All alternatives illustrate compromises made in silviculture and timber management. Alternatives PA, B, C, and D allocate between 74 percent and ninety percent of the tentatively suitable acres to timber management. On these unsuitable coniferous acres, stand health and vigor declines and susceptibility to epidemic insect and disease outbreaks increases. Growth rates in the fifth decade vary from fifty percent of the LTSYC in Alternative B, to eighty percent in Alternative E. This analysis indicates that an irretrievable commitment of potential productivity is made under each alternative.

Increased fire hazard from slash created following intermediate cutting is an unavoidable short-term adverse effect for all alternatives. This adverse effect is mitigated through fuel treatment.

A reduction in visual diversity results under Alternative A from timber harvest activities along road corridors that may be considered visually sensitive in the future from increased recreation use.

Wildlife - Alternative A results in declining wildlife habitat diversity and capability.

Lands - Alternatives A and E only allow infrequent field inspection of special land use permits which may eventually lead to long-term management problems.

Minerals - Additional mineral withdrawals are recommended in all alternatives and may inhibit locatable mineral activities to some degree. Important wildlife habitats may be lost or severely impacted during primary use seasons from both locatable and leasable mineral activities under Alternatives B and D. Seasonal restrictions imposed on prospecting and exploration activities may increase mineral operating costs under all alternatives.

Air Quality - Transitory and localized effects will occur in all alternatives because of smoke from wildfire and prescribed burning. Alternative E results in the most area burned, followed by B, PA, C, D, and A in decreasing order of area burned.

3. Affected Environment

OVERVIEW

This chapter describes the environment that will be affected by the Forest Plan or alternatives to it. Chapter 3 is a brief summary of the Analysis of the Management Situation, available in the planning record at the Forest Supervisor's Office. The chapter is presented in three parts. The first part describes the physical and biological setting; the second part, the socio-economic setting; and the third part, the current resource situation and management for specific resource elements.

PHYSICAL AND BIOLOGICAL SETTING

The Kaibab National Forest is one of 11 National Forests in the Southwestern Region, and one of 154 National Forests in the United States. The Forest was formed in 1934 by combining the Kaibab and Tusayan National Forests. These Forests had been formed by various boundary changes and additions to the Grand Canyon Forest Reserve (created by Presidential proclamation in 1893) and the San Francisco Mountains Forest Reserve (Created by Presidential proclamation in 1898).

Physiography

Because of its physical location and dramatic differences in elevation, the Forest includes a wide variety of landforms and plant and animal habitats.

The northern one-third is generally dominated by the high Kaibab Plateau surrounded by the rugged canyons of the Colorado River and its tributaries. The plateau reaches 9,200 feet elevation and is distinguished by its sinkholes and long open valleys characteristic of karst topography. The lowest elevation in Jumpup Canyon is approximately 3,000 feet.

The southern two-thirds of the Forest is part of the Colorado Plateau, dominated by many cinder cones and volcanic peaks. Elevations range from about 4,800 feet in Sycamore Canyon to 10,418 feet at the top of Kendrick Peak, the highest point on the Forest.

Climate

Four principal climatic zones are found within the Forest; boreal, cold temperate, warm temperate, and semi-arid. The boreal zone is generally the area above 8,500 feet and is characterized by mixed conifer forests. Average annual temperature is 39° F and precipitation ranges from 24 to 32 inches per year. The cold temperate zone lies between 7,000 and 8,500 feet and is dominated by ponderosa pine forest. Average annual temperature is about 43° F and precipitation ranges from 18 to 24 inches annually. The warm temperate zone, characterized by pinyon-juniper woodland, generally lies below 7,000 feet, averages 54° F, and receives 14 to 18 inches of precipitation annually. The semi-arid zone typically ranges in elevation from 3,000 feet to approximately 4,000 feet. Average annual temperature is 61° F, and the zon receives eight to twelve inches of precipitation. The growing season ranges from 80 days at the high elevations to 180 days in the warmer zones.

Geology and Soils

The Forest is in the Flagstaff and Grand Canyon sections of the Colorado Plateau physiographic province. Soils of the North Kaibab and Tusayan area have developed mainly from the Permian Kaibab limestone or Coconino sandstone of the Paleozoic era. On the southern part of the Forest, soils are derived principally from extrusive igneous rocks of the Quaternary and Tertiary periods. Major igneous rocks are basalt, cinder, and rhyolite.

The soils are variable in rock and clay content, depth, organic matter content, pH, fertility, color, and erosion potential. This wide variation is the result of differences in vegetative types, climatic conditions, topography, and varied parent rocks.

Vegetation

Vegetation varies from the Engelmann spruce and subalpine fir at the highest elevations to blackbrush in the lowest desert zone. In between, vegetation is represented principally by ponderosa pine forest and pinyon and juniper woodland. Big sagebrush is a characteristic component of the woodland zone in the northern one-third of the Forest.

Ponderosa pine with some interspersion of Gambel oak covers the majority of the commercial timber lands. Isolated stands of aspen occur throughout the commercial timber lands, as do various grassland communities. The pinyon-juniper woodlands

consist of pinyon pine, Utah juniper, and one-seed juniper with some alligator juniper at the higher elevations. Seral grasslands are intermixed in the pinyon-juniper woodland zone.

The lowest and driest vegetative zone consists of the desert grassland and desert shrub plant communities, primarily blackbrush, galleta, Indian rice-grass, and sand dropseed. Within this zone an area of riparian vegetation consisting principally of Fremont cottonwood, salt cedar, and mesquite is found.

SOCIAL AND ECONOMIC SETTING

The primary social and economic zone of influence for the Kaibab National Forest is Coconino and Yavapai Counties. The Forest covers over 1.5 million acres in these two counties, with about 5,000 acres in Mohave County. Forest influenced activities and outputs are associated with less than 5 percent of the total employment in Coconino County. Yavapai and Mohave Counties are not significantly affected economically by activities on the Kaibab, but Forest use by people from those areas is important to Coconino County. Another primary source of significant effect is from the Phoenix metropolitan area in Maricopa County.

The Kaibab is within the zone of influence of several Indian tribes. Bordering land areas include the Navajo and Havasupai homelands. Nearby groups include the Hopi, Kaibab Paiute, Yavapai-Prescott and the Hualapai. All of these groups have a history of aboriginal use of parts of the Kaibab, and for some, there is still active use of the Forest for recreation, gathering of fuelwood and other material, employment, and road and trail access to their homes. Parts of the Forest have historical, religious, or other traditional significance to these people.

The Salt River Valley and the Colorado River Valley are considered to be a secondary zone of influence. People from these areas are within a reasonable driving distance of the Kaibab, therefore, a good proportion of Forest use is from those areas for recreation, climatic relief, some employment, and product gathering.

Population

Four sub-areas have been identified for the Kaibab zone of influence. The first consists of Flagstaff and Prescott. Both cities are among the faster growing communities in the state with their combined populations approaching 55,000.

Principal employment sectors are government, wholesale and retail business, followed closely by seasonal tourism. Both communities rely on Forest lands to a large extent for recreational activities, such as camping, skiing, hunting and sightseeing.

The second population includes Williams, Ashfork and Parks, and the surrounding rural subdivisions. These residents depend primarily on retail sales and services to travelers and tourists and small industry, including lumber, pulpwood harvest, and rock quarries. This area also has many summer home owners, retirees, and rural lifestyle residents who commute to jobs in other areas, or live on a subsistence level, using the Forest for recreation, fuelwood and as a wildland backdrop for their homes.

In the Grand Canyon-Tusayan Village area, employment is heavily oriented around the tourism and transportation services connected with the National Park and the Grand Canyon Airport.

The Fredonia-Kanab-Page area is similar to the situation at Williams where the local economy is heavily dependent on retail sales and services to tourists. More industry exists, or is under development, and there is a greater potential for higher levels of personal uses of the Forest by the growing population.

Table 38 displays population trends for the primary zone of influence. The population of the area is expected to almost double between 1980 and 2000. Recent studies show that, nationally, population growth is most pronounced in the west, with the northeast actually losing population. People are, and will continue to be, attracted to western states, especially sunbelt states like Arizona because of the climate, scenery, variety of outdoor recreation activities, natural resources, and the booming economy.

Table 38. Population Trends for Areas Influencing the Kaibab National Forest

Year	State of Arizona	Coconino County	Yavapai County	Maricopa County
1950	745,[illegible]87	23,910	24,991	331,770
1960	1,301,161	41,857	28,912	663,510
1970	1,775,399	48,326	37,005	971,228
1980	2,718,000	75,008	68,500	1,500,000
2000	4,751,000	130,500	131,500	2,883,000

Employment and Income

In 1979, the per capita income was $7,155 in the zone of influence. From 1920 to 1977, Coconino County's personal income rate grew at an average annual rate of 13.9 percent, and Yavapai County's at 15.9 percent, compared to a national average of 9.8 percent. On a per capita basis, both counties have grown closer to the national average for per capita personal income; Coconino at 74 percent and Yavapai at 87 percent of the national average.

The June, 1984, unemployment rates for the two counties were; Coconino County, 8.2 percent, and Yavapai County, 7.4 percent. The total labor force was estimated to be 65,575, of which 60,350 were employed, and the overall unemployment rate was 7.8 percent.

The National Forest has a number of direct and indirect effects on the economy of the area. For example, a total of 600 workers are employed in the timber industry directly dependent on timber provided by the Kaibab National Forest. This employment is significant to local communities such as Fredonia where over 75 percent of employment is connected directly with the timber industry. In Williams almost twenty percent of the local employment is timber connected. This activity has a direct multiplier effect on the economy, both locally and regionally, so that a total of sixteen million dollar value of forest products manufactured by dependent industry is significant to Arizona. During 1984, the total collections by the Kaibab National Forest which were paid to local counties amounted to $4.1 million.

Tourism is the largest economic activity in the area, and it has been estimated that about 30 percent of the outdoor recreational use in the state takes place in Coconino County. Although a good portion of this figure is due to Grand Canyon National Park, other attractions such as National Forests bear a considerable part of this use. About 28 percent of the land in Coconino County is National Forest.

Lifestyles

The National Forest not only provides direct economic benefits, but is the landscape setting for a way of life which is significantly different from many areas of the country. Here the public lands provide open space as a setting, with recreational opportunities to residents of the area as well as to visitors. Freedom to hunt, fish, hike or to gather fuelwood for winter warmth are significant values to the people of Northern Arizona.

Lifestyles for the most part are influenced by strong frontier values of self-reliance and the rights of individuals. This also influences attitudes about land use toward personal values and perceptions. People are concerned about land use decisions and are jealous of their rights to free access and enjoyment without interference by others.

People who live within or close to the Forest are most interested in and affected by resource management. They may own a cabin, backpack, ski, snowmobile, fish, gather fuelwood, hunt, hike, camp, or picnic. If they gather fuelwood, the fresh air and exercise will probably be as important to them as the economic value of the wood. The Forest substantially enhances their quality of life. These people have a proprietary interest in Forest management decisions and resource uses.

Some people earn all or part of their income from the Forest. They depend on such things as timber harvest, mining, grazing livestock, operating a service business in

the Forest, outfitting and guiding, or cutting poles, posts, or fuelwood for their own living.

Another substantial group of people are visitors to the Forest from out of state or from the large population centers of Arizona. They are interested in the climatic relief the area provides from desert heat, or in the scenery, wildlife, or other natural features of the area. To them, the Forest may be an outdoor museum, a wilderness backdrop for their recreation, or a sanctuary for plants or animals they feel must be protected.

RESOURCE ELEMENTS

Developed Recreation

The Kaibab's eight public sector campgrounds provide an annual developed capacity to accommodate almost 380,000 persons depending on available financing and length of operating season. Generally, the operating season runs from May through October. Fees are charged at seven of the campgrounds, with total annual receipts exceeding $140,000.

Additional public sector developed sites provide an annual capacity to accommodate over 49,000 persons. Sites in this category include visitor information centers, day-use picnic areas, rest areas and snowplay areas.

All public sector developed sites are operated and maintained to meet minimum health and safety standards. Heavy maintenance of toilets, roads, tables, etc. is sporadic due to insufficient funding. As a result, facilities in public sector developed sites are generally deteriorating. In the recent past, campgrounds on the North Kaibab Ranger District have been operated by concessionaires as a means of reducing Forest Service operating costs. This also has the effect, however, of reducing income to the U.S. Treasury generated through recreation fee collections.

Table 39. Capacity and Use of Existing Major Developed Recreation Sites

Developed Rec. Site	Site Capacity In PAOT's	1983 Use In RVD's	Use as a Percent Of Potential Capacity
Public Sector			
Cataract Lake Campground	90	9,900	64
Kaibab Lake Campground	300	36,200	85
White Horse Lake Campground	425	51,000	52
Dogtown Lake Campground	360	26,305	50
Ten-X Campground	350	22,500	62
Jacob Lake Campground	588	56,527	51
DeMotte Campground	100	6,500	88
Indian Hollow Campground	10	100	10
Private Sector			
White Horse Lake Concession	104	28,000	76
Jacob Lake Inn	250	42,900	42
Kaibab Lodge	150	12,000	38
Moqui Lodge	480	32,200	61
Williams Country Club	75	6,000	62
Williams Ski Area	100	1,997	101

* Persons at one time (PAOT) - A recreation capacity measurement term.

** Recreation visitor day (RVD) - Aggregates 12 hours. It may consist of one person for 12 hours, two people for 6 hours, or any combination that totals 12 hours.

The developed site operation and maintenance program utilizes volunteers as campground hosts for minor site clean-up and information services. This has enabled the Forest

to partially offset recent budget cuts in recreation financing. Typically, the annual volunteer contribution at each campground is one-half person-year.

Private sector facilities on the Forest provide an annual capacity to accommodate approximately 286,000 persons. Private sector sites are those recreation developments operated by the private sector under special-use permit. Sites in this category presently include lodges, restaurants, ski areas and recreation residences. Operation and maintenance standards are met at all facilities through an on-going program of special-use compliance inspections.

Proposals for expansion of existing facilities or new facilities are tied to the preparation of environmental assessments and site concept plans. Plans are reviewed to ensure compliance with federal, state, county and local building codes.

The private sector, through concessionaire permits, is viewed as a source of supply for increased campground and lodge capacity on the Forest. This is especially needed to accommodate visitors to the Grand Canyon National Park.

Future Trends. Developed recreation output for both public and private sectors for 1983 was estimated at over 309,000 recreation visitor days (RVD). Some surplus capacity exists in both sectors, however, most of the surplus exists in the private sector. Based on an analysis of past use, the Forest can expect to incur moderate increases in developed recreation demand. Annual developed recreation outputs are expected to reach almost 600,000 RVD's in both sectors by 1990. This closely coincides with the practical maximum capacity of existing developed sites. Even using the most conservative projections, use of lodge facilities in the private sector and overnight campground facilities in the public sector will generally reach or exceed existing capacities by the end of the first planning period.

Developed recreation outputs could be increased through the construction of specific projects. Examples in the public sector are Highway 64 visitor center and the expansion of Cataract Lake and Ten-X campgrounds. Private sector projects could include development of a new ski area on Bill Williams Mountain, the impacts of which have been addressed and evaluated in a separate EIS approved on June 13, 1985, and subsequently appealed, expansion of Moqui Lodge, Jacob Lake Inn, Kaibab Lodge and the construction of private sector campgrounds near the Grand Canyon National Park. The development of a new expanded ski area on Bill Williams Mountain would serve to partially meet the demand for additional private sector alpine ski capacity in Northern Arizona.

Table 40. Developed Recreation Use Projections in MRVD's

Year	Private Sector	Public Sector	Total
1990	324.1	270.8	594.9
2000	411.1	408.6	819.7
2010	498.1	546.4	1044.5
2020	585.1	684.2	1269.3
2030	672.1	822.0	1494.1

The need for additional camping facilities, snow play areas and picnic areas are among the top developed recreation priorities specified for Coconino County in the Arizona Statewide Comprehensive Outdoor Recreation Plan.

Based on various expressions of demand or need it appears there is, or soon will be, a shortage of developed recreational facilities in both the public and private sectors. It is evident that existing recreational facilities in both sectors are operating at or near their physical capacities, however, it appears a potential demand exists far greater than the current Forest supply. This demand could be met if additional public and private sector facilities (campgrounds, lodges, etc.) were constructed. With the exception of lake oriented campgrounds and visitor information services, the increased developed recreation output can be provided by the private sector.

Dispersed Recreation

The dispersed recreation management program on the Kaibab focuses primarily on maintenance of Forest system roads in the commercial timber types which provide access to scenic vistas and observation points, water impoundments and popular dispersed camping areas. Other recreation management activities include inspection and maintenance of popular dispersed camping areas, publication of information brochures, news releases, dissemination of information at ranger district offices and the maintenance of hiking trails and cross-country ski trails.

Maintenance of the Forest's 162.1 miles of hiking and cross-country ski trails is conducted on a periodic basis; the frequency determined by trail use, need for maintenance and available financing. A low level of maintenance, tied primarily to insufficient funding, has resulted in a generally lower standard of maintenance than is desired over most of the Forest's trail system.

Table 41. Trail Inventory

Trail Name	Trail No.	Miles	Trail Name	Trail No.	Miles
Pine Flat Stock	73	3.0	Sycamore Canyon	20	1.7
Big Springs Canyon	70	0.6	Deadman	29	1.1
Pumpkin	39	5.1	North Bill Williams	21	2.7
Bull Basin	40	1.8	Benham	38	2.2
Dogtown Nature	43	0.4	Sycamore Rim	45	7.5
Clover Springs	46	0.4	Echo Canyon	49	3.3
Beale	61	6.1	Sitgreaves X-country	77	8.0
White Horse Lake	33	0.4	Dogtown Lake	44	1.1
West Dogtown	48	0.3	Ten-X	42	1.0
Red Butte	37	0.7	Colcord Canyon	24	0.1
Kendrick	22	3.4	Kenbull Connector	80	2.0
Jacob Canyon	35	2.5	Jacob Lake	34	1.0
North Canyon	4	7.0	Crystal Springs	36	0.5
Nankoweap	57	5.0	Kane	3	2.5
Little Spring	13	1.0	Slide Spring	11	1.0
Thunder River	23	1.0	South Canyon	6	2.0
East Rim	7	1.5	Jumpup-Nail	8	6.0
Sowats Spring	14	1.0	Saddle Mountain	31	5.0
Slide Canyon	58	7.0	Snake-Kanab	59	22.0
Ranger	41N	25.0	Swapp	50	2.0
Lawson	18	1.8	Hack Canyon	28	1.2
Chamberlain Canyon	32	0.7	Moqui Horse	52	4.0
VT Horse	53	3.0	Ski Run	54	1.5
Parks Rest Area	55	0.3	Kwagunt	94	2.0
Big Sprngs Lookout	51	1.7			

Volunteers assist the dispersed recreation program with trail maintenance. The annual contribution approaches one person-year for the program.

Under the State-wide Off-Road Vehicle [ORV] Management Plan, nineteen sensitive areas of the Forest totaling 11,392 acres are closed to motorized ORV's, or use is restricted. Closure or restrictions are for protection of important wetland habitats, unique geology or sensitive soil and vegetation. Table 42 displays existing ORV closures or restrictions.

Table 42. Existing ORV Closures

Area Name	District	Acres	Reason for Restriction	Restricted Vehicle Type
500 KV Powerline	Wms.	1478	Sensitive soil	All
Coleman Lake	Wms.	158	Wetland	All
Cedar Mountain	Chal.	772	Sensitive soil	All
Red Butte	Tus.	1230	Unique geology	All
Davenport Hill	Chal.	503	Sensitive soil	All
Mineral Lake	Chal.	60	Wetland	All
Scholz Lake	Chal.	106	Wetland	All
Pouquette Hill	Chal.	278	Sensitive soil	All
Davenport Lake	Chal.	198	Wetlands	All
Dry Lake	Chal.	52	Wetlands	All
Klostermeyer Hill	Chal.	143	Sensitive soil/veg.	All
Government Knolls	Chal.	328	Sensitive soil/veg.	All
Kramer Hill	Chal.	191	Sensitive soil/veg.	All
Antelope Hill	Chal.	100	Sensitive soil/veg.	All
Williams Junction Lake	Chal.	40	Sensitive soil/veg.	All
Moquitch Canyon	N.K.	1718	Sensitive soil	All except snow
Warm Springs Canyon	N.K.	1706	Sensitive soil	All except snow
Pleasant Valley Park	N.K.	1141	Sensitive soil/veg.	All except snow
DeMotte Park	N.K.	1190	Sensitive soil/veg.	All except snow

ORV use will increase and future closures or restrictions may be needed for protection of natural resources or public safety. Snowmobile use has increased in recent years.

Dispersed recreation output for the Forest for 1983 was estimated at over 735,000 RVD's. Of this total, approximately 505,000 RVD's are associated with road use on state highways to the Grand Canyon National Park and Interstate 40 which has a relatively minor impact on Forest management and resources. Principal types of existing dispersed recreation use include camping in an undeveloped setting and sight-seeing along Forest system roads.

Table 43. Current Acreage and Annual Recreation Use in RVD's by ROS Setting

	Recreation Opportunity Setting*					
	P	SP	SPM	RN	R	Total
ROS Acreage	110,870	101,112	307,721	1,013,194	1,558	1,534,453
Dispersed Use**	0	415	29,748	196,039	0	226,202
Wilderness Use	3,757	0	0	0	0	3,757
Developed Use	0	0	0	0	309,202	309,202
Total All Uses	3,757	415	29,748	196,039	309,202	539,161

* Recreation Opportunity Setting: P = Primitive; SP = Semi-Primitive; SPM = Semi-Primitive Motorized; RN = Roaded Natural ; R = Rural

** Dispersed Recreation Use excludes present state highway and interstate use of 505,000 RVD's per year and use associated with wildlife activities

The total Forest area of over 1.5 million acres can be broken down by the use of Recreation Opportunity Spectrum (ROS) classes. ROS classes provide a framework for defining the types of outdoor recreation opportunities the public desires, and

identifying what portion of the spectrum the Forest might be able to provide. An analysis of Table 43 shows the bulk of current dispersed recreation use occurs in the roaded natural areas which accounts for 67 percent of the total land area.

Future Trends. Table 44 represents projected dispersed use if population growth predictions hold up and transportation costs do not change dramatically. The practical maximum dispersed recreation capacity for the Forest has been estimated to be over 2,700,000 RVD's annually. The relationship of projected use to maximum theoretical capacity indicates that available dispersed supply exceeds the most optimistic demand projections.

Table 44. Dispersed Recreation Use Projections in RVD's

Year	Projected Annual Use*
1990	258,200
2000	289,700
2010	321,200
2020	352,700
2030	384,200

* Projected annual use excludes projected average annual state highway and interstate use of 691,800 RVD's and wildlife recreation use.

The Arizona Statewide Comprehensive Outdoor Recreation Plan identifies the desire for additional hiking trails and trailhead facilities, cross country ski opportunities and ORV closures in the Coconino County assessment area.

The available supply for dispersed recreation activities appears to presently be in excess of overall demand, although there is a need for additional dispersed facilities including hiking trails, cross country ski trails, dispersed water impoundments, scenic vistas and publication of informational materials. A more regular schedule of inspection and maintenance is needed to prevent deterioration of popular dispersed camping areas. Areas now classified as semi-primitive and semi-primitive motorized are in limited supply and need to be managed to maintain their existing ROS classification. Off-road vehicle use is not currently a serious problem, but requires continuing attention and management to prevent degradation of sensitive areas and user conflicts.

Wilderness

The Arizona Wilderness Act of 1984 [PL 98-406] added Kanab Creek, Saddle Mountain and Kendrick Mountain to the National Wilderness Preservation System. It released all other roadless areas to multiple-use management which were analyzed in the 1979 Roadless Area Review and Evaluation [RARE II] study. PL 98-406 states, in part, "...the Department of Agriculture shall not conduct any further statewide roadless area review and evaluation of National Forest System Lands in the State of Arizona for the purpose of determining their suitability for inclusion in the National Wilderness Preservation System." The designation of additional wilderness was, therefore, not considered in Forest Plan alternatives.

Management of the Sycamore Canyon Wilderness, which encompasses portions of three National Forests including the Kaibab, is addressed in the Coconino National Forest Plan. The Kendrick Mountain Wilderness includes portions of both the Kaibab and Coconino National Forests. Management direction for Kendrick Mountain is covered in the Kaibab Forest Plan.

The Forest manages 110,870 acres of designated wilderness in three distinct areas; Kanab Creek, Saddle Mountain and Kendrick Mountain. Wilderness areas comprise 7 percent of the total land area of the Forest. The three wildernesses are utilized for a variety of recreation activities including hiking, camping, viewing scenery and hunting.

Kendrick Mountain, reaching an elevation of 10,418 feet, is one of several mountains of volcanic origin on the south side of the Kaibab. The slopes of Kendrick Mountain are densely forested with ponderosa pine at the lower reaches and mixed conifer and

aspen at the higher elevations. A fire-lookout tower occupies a portion of the summit of Kendrick.

Saddle Mountain occupies the steep, broken southeastern slopes of the uplifted Kaibab Plateau. Vegetative types of Saddle Mountain, varying from high elevation mixed conifer and aspen to low elevation shrub grassland, are indicative of the wide range of landscape and climatic settings found in the area. North Canyon, a perennial stream within Saddle Mountain Wilderness, contains one of the purest populations of the endangered Apache trout.

Kanab Creek is an immense tributary of the Grand Canyon which separates the forested Kaibab Plateau from the Arizona Strip country of the Kanab Plateau. It is characterized by steep, rugged canyon walls vegetated with sparse high elevation desert shrubs and grasses. Kanab Creek contains the largest stretch of riparian habitat found on the Forest. Desert bighorn sheep have recently been re-introduced adjacent to this rugged canyon environment.

Both Kanab Creek and Saddle Mountain wilderness areas lie adjacent to the Grand Canyon National Park.

A wilderness can be classified by its Wilderness Opportunity Spectrum (WOS) settings. The WOS concept is essentially a system for subdividing the wilderness into distinct management units possessing homogeneous landscape and social setting characteristics. Table 45 displays acres by WOS class for each of the three wilderness areas managed by the Kaibab.

Table 45. Wilderness Areas by WOS Setting

Wilderness	Pristine	Primitive	Semi-Primitive	Transition	Total
Kendrick Mountain	0	4060	2450	0	6510
Kanab Creek	10,928	27,217	20,035	5,580	63,760
Saddle Mountain	0	15,148	21,068	4,384	40,600

Future Trends. Estimated use for 1983, projected use and potential capacity for the three wilderness areas is displayed in Table 46. Use of Kanab Creek and Saddle Mountain is currently low due to their remoteness and relative unknown status in the wilderness system. Kendrick Mountain receives primarily day-use because of it's small size and proximity to Flagstaff.

Table 46 Average Annual Current, Projected Use and Potential Wilderness Capacity in RVD's

Wilderness	1983 Use	Potential Capacity	Projected Use 1990	2000	2010	2020	2030
Kendrick Mtn.	840	2,900	1,980	2,200	2,400	2,700	2,900
Saddle Mtn.	1,210	10,700	2,700	3,100	3,400	3,700	4,100
Kanab Creek	1,200	9,900	2,700	3,000	3,300	3,600	4,000

All wildernesses are managed at less than standard service level. Management of the three wilderness areas is generally limited to inspection and monitoring of primary use areas in the transition and semi-primitive WOS classes, occasional patrols along wilderness perimeters to prevent and detect intrusion of non-conforming uses such as ORV use and fuelwood gathering and maintenance of the 62.4 miles of wilderness hiking trail. Due to funding limitations, many of these current wilderness management

activities are accomplished in conjunction with other resource functions such as fuelwood and fire prevention patrols and range condition and use surveys. As a result, very little emphasis is currently placed on visitor contacts and encouragement of "no-trace" camping ethics.

No wilderness is significantly threatened from the outside by fire, insects or disease. However, complete fire suppression on Kendrick Mountain has prohibited the continuation of the natural vegetative mosaic. The resulting continuous fuelbed is highly susceptible to devastating fires. The threat of non-conforming uses is also considerably greater for Kendrick Mountain due to it's accessibility and the intensive use of adjacent non-wilderness lands.

With the exception of Kendrick Mountain, potential capacity for all wilderness areas is far greater than projected use through year 2030. Use of Kendrick Mountain will reach estimated theoretical capacity in the fifth planning period. A more intensive monitoring and administration program is needed to evaluate use and identify opportunities for improving the quality of the wilderness experience. Use restrictions and visitor education, particularly in high use areas, will be necessary to prevent deterioration of the wilderness resource.

Visual Resources

The wide variety of topographic, geologic and vegetative characteristics of the Forest provide a rich and diverse visual resource. Prominent features include Bill Williams, Kendrick and Sitgreaves mountains, large expanses of coniferous forest and portions of the North Rim of the Grand Canyon.

Visual quality on the Forest has been altered to some degree by activities such as timber harvest, road construction, vegetative type conversions, mining and utility corridors.

In order to protect and manage visual resources, visual quality objectives have been assigned for all areas of the Forest. The visual quality objectives are essentially based on the physical characteristics and public's concern for a given area. Allowable changes vary from none in preservation to a considerable amount in modification and maximum modification. Rehabilitation acreage represents highly visible road cuts and mined areas needing restoration.

Table 47. Acres by Visual Quality Objective

Preservation	Retention	Partial Retention	Modification to Max Modification	Rehabilitation
110,870	5,371	82,265	1,333,947	2,000

Visual quality objectives for most areas of the Forest are achieved. However, there are instances where the allowable modification is not completed in a timely manner or in totally keeping with guidelines that require immediate clean up of the resource activity. Approximately thirteen of the Forest is currently identified as having visual quality objectives of preservation, retention and partial rentention. These visual quality objectives only allow for minor changes in the landscape elements of line, form, color and texture.

The primary visual management goal is to maintain or improve the landscape diversity in retention and partial retention areas through a variety of tree age classes. Modified even-aged timber management practices are generally compatible with this goal.

Future Trends. Continuing current management practices will achieve, in part, the visual quality objectives in the retention and partial retention areas. There may, however, be a gradual decline in the diversity of these areas if timber harvesting activities are not modified to address species diversity, stand size and age class distribution. The bulk of the Forest is considered open for modification and the diversity of these areas will be increasingly limited. A change in the assigned visual quality objectives for some of these areas may be necessary to more accurately reflect their sensitivity to alteration.

Cultural Resources

Based upon cultural resource sampling to date through survey of approximately eight percent of the land area of the Kaibab, it is estimated that there are about 28,000 prehistoric and historic archeological sites located on the Forest. Although sites may be found in any and all parts of the Forest, their distribution is not uniform. Over seventy percent of all sites are located in areas of pinyon and juniper, or in the transition zone between ponderosa pine and pinyon-juniper. The average size of a site on the Forest is 0.75 acres, and thus an estimated 21,000 acres of ground surface within the Forest are occupied by sites.

Cultural resource sites represent different cultural groups during different periods and are reflective of a variety of functional activities ranging from habitation to hunting camps. The earliest sites pertain to the Desert culture and date between 2,000- and 7,000-years ago. Desert culture sites are followed in time by sites of the prehistoric Cohonino, Kayenta Anasazi, Sinagua and Cerbat cultures south of the Grand Canyon and of the Virgin Anasazi, Kayenta Anasazi and Paiute cultures north of the Grand Canyon. Historic aboriginal use of the North Rim area was by Paiute peoples, while Yavapai, Havasupai, Hopi and Navajo peoples used the Forest south of the Grand Canyon.

Given the social organizational level and subsistence practices of various prehistoric groups which have occupied and utilized the Forest in the past, the sites located here are generally not as large, complex, nor as spectacular as cultural resource sites in other parts of the Southwest. Their value resides principally in their potential to yield information important to social scientific studies of history and prehistory. Some of this information can be of use in answering general anthropological questions and some is relevant to questions regarding regionally unique cultural groups or regionally unique expressions of more widespread groups.

Historic Anglo sites on both sides of the Grand Canyon pertain to such activities as mining, logging, railroading, ranching and homesteading. In addition, the Forest is traversed by a 23 mile section of the historic Beale Wagon Road. Portions of this trail on the Forest have been incorporated into the system of Forest Service roads, but most of it is still intact. A study conducted on the Kaibab portion of the Beale Wagon Road indicates it has potential as a National Historic Trail.

Current cultural resource practices on the Forest are aimed at compliance with various legal mandates and consist of a program of site inventory, evaluation, protection and consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation. Cultural resource survey is conducted in advance of all ground-disturbing projects, either by Forest Service personnel or qualified cultural resource contractors. All sites located during survey are inventoried and given a preliminary evaluation sufficient to determine whether they should be protected. Site protection is carried out through marking of a site's bounderies so that it can be avoided during project activities. Projects in progress are often monitored and, when complete, sometimes receive follow-up inspection. Although site evaluation should eventually be carried out in sufficient detail to determine if a site is eligible for nomination to the National Register of Historic Places, only two sites so far have been nominated to and listed on the register because of funding limitations. The two sites are Laws Spring, a water source associated with the Beale Wagon Road, and Hull Cabin, an 1890's log cabin currently in use as a Forest Service administrative facility. The Beale Road, displayed on the Forest corridor map, has now been marked on the ground to prevent disturbance to intact portions.

Future Trends. Cultural resource survey and related site inventory, preliminary evaluation, and marking for protection in advance of all ground-disturbing projects will continue. The legal requirement to inventory all cultural resource sites on the Forest will be partially met through project-related survey. The number of inventoried sites which have not received thorough evaluation will continue to grow. Information pertaining to cultural resources of areas where there is a low level of projects, and therefore little survey work, will continue to be lacking.

Wildlife and Fish

The diversity in climate, vegetation and physical features provides habitat for a wide variety of wildlife and fish species. Table 48 displays the various classes of vertebrates and their stratification by game species.

Table 48. Number of Total Species/Game Species by Class

Class	No. of Species	Game Species
Mammals	87	14*
Birds	253	23
Reptiles	34	0
Amphibians	9	1
Fishes	9	6
Total	392	44

*Includes migratory birds.

Diversity. Diversity is the relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area (Thomas, 1979). The following table represents the Forest stratification by vegetative types.

Table 49. Major Vegetative Types*

Type	Acres
Seral grassland	25404
Shrub grassland	46402
Ponderosa pine	532485
Mixed conifer	142590
Woodland	786036

*Does not include 1,556 acres of developed recreation sites.

A change in vegetative composition or a change in vegetative volume or structure will effect the quantity of diverse habitats and animal taxa which utilize those habitats. A managed forest which offers a high degree of diversity in communities and seral stages not only ensures ecological stability but provides habitat for diverse wildlife.

Diversity in habitats and animals is almost exclusively dependent on the level of wildlife planning, habitat improvement, and coordination with other resource activities. Stand diversity is established and maintained through integrated stand management to provide suitable habitat for wildlife on lands suitable for timber production, while maintaining or enhancing timber production and timber age class distribution to achieve regulation.

A primary factor affecting diversity within wilderness areas is the level of prescribed fire utilized to increase habitat diversity. Levels of prescribed fire ignitions in wilderness ecosystems will need to be integrated with the management objectives for those areas.

Management indicator species were selected to include at least: endangered and threatened plant and animal species identified on state and federal lists for the planning area, species with special habitat needs that may be influenced significantly by planned management programs, species commonly hunted, fished, or trapped and plant or animal species selected because their population changes are believed to indicate effects of management activities on other species of a major biological community or on water quality.

Seventeen management indicator species were selected for planning purposes. These seventeen species indicate the sensitivity of the other wildlife species found on the Forest to management activities. The indicator species are elk, goshawk, pygmy nuthatch, turkey, hairy woodpecker, red squirrel, spotted owl, mule deer, Abert

squirrel, yellow-bellied sapsucker, plain titmouse, pronghorn antelope, Lincoln's sparrow, Lucy's Warbler, yellow-breasted chat, macroinvertebrates, and cinnamon teal.

The Arizona Wildlife and Fisheries Comprehensive Plan sets the following goals and objectives applicable to the Kaibab:

Pronghorn antelope	Goal: Increase the number of pronghorn antelope in Arizona and maintain a conservative hunting program.
	Objective: By 1985, increase pronghorn numbers twenty percent in Game Management Units: 7 [Chalender R.D.], 8 [Chalender R.D. and Williams R.D.], and 12A [North Kaibab R.D.].
Black bear	Goal: Maintain black bear while minimizing depredation problems. Maintain the harvest near the current level until information is available to improve estimates of the harvestable surplus.
Mule deer	Goal: Increase the numbers of mule deer to increase the harvest and quality of the firearms hunt. Meet demand for archery hunting.
	Objective: By 1985, increase state-wide mule deer numbers to provide for a ten percent increase in the average annual harvest. Increase mule deer populations by twenty percent above current levels in Game Management Units: 7, 8, and 12A.
White-tailed deer	Goal: Increase the numbers of white-tailed deer by improving the quality of habitat. Improve the quality of hunting.
Elk	Goal: Manage elk populations at the best levels in relation to the carrying capacity of the habitat while increasing opportunities for hunting.
	Objective: Maintain elk numbers near current levels in the central mountains. Improve habitats to offset habitat losses to support current populations in Game Management Units: 7, 8.
Bison	Goal: Maintain bison numbers at levels compatible with good range habitat management.
	Objective: Maintain bison herds at levels which will increase the relative abundance of palatable plant species and increase plant vigor. Maintain bison herds at levels which will encourage winter use of the House Rock Ranch by Kaibab mule deer.
Mountain lion	Goal: Maintain the mountain lion while minimizing depredation problems and meet demand for sport hunting within limits of harvestable surplus.
Turkey	Goal: Maintain turkey numbers, meet demand for fall turkey hunting, and maintain the quality of the spring hunt.
	Objective: Maintain turkey populations in Game Management Units: 7, 8.
Tree squirrels	Goal: Improve the status of native species of tree squirrels and meet demand for sport hunting within the harvestable annual surplus.
Blue grouse	Goal: Maintain or improve all existing blue grouse habitats on the Kaibab National Forest.

Table 50. 1984 Big Game* Populations

Species	Population Estimates
Elk	1,280
Mule deer	18,500
Turkey	3,400
Mountain lion	80
Pronghorn antelope	520
Black bear	60
Desert bighorn sheep	5
Bison	120
White-tailed deer	100
Javelina	30

*There are no significant data on populations of small game and non-game species.

Table 51. Big Game Harvests and Population Levels for 1984

Species	Estimated Population [1]	Population Trend [1][2]	Actual Harvest [1]
Elk	1,280	+	170
Mule deer	18,500	+	2000
White-tailed deer	100	0	20
Pronghorn antelope	520	-	40
Turkey	3,400	-	340
Javelina	30	0	0
Black bear	60	0	3
Mountain lion	80	0	11
Bison	120	0	25
Desert bighorn sheep	5	0	0

[1] Source: Arizona Game and Fish
[2] + increasing, 0 stable, - decreasing

Old-growth. Old-growth habitats in forested ecosystems are vital elements of forest diversity and productivity. Spatial distribution and between stand diversity will be promoted in old-growth prescriptions to induce or retain age-complexity of managed forests. The threshold definitions for old-growth characteristics for ponderosa pine, mixed conifer, and pinyon-juniper, respectively have been developed and described.

Old-growth prescriptions on tentatively suitable acres actually exhibit old-growth characteristics for only 33 percent of the rotation. Therefore, for every acre needed in old-growth, three acres are allocated to old-growth management. Standard silvicultural practices are applied to the stand until CMAI. The seed cut is then deferred until the stand is 210- to 240-years old.

Alternative PA manages 101,300 acres for old-growth habitat, representing fifteen percent of the forested lands on the Kaibab National Forest. These 101,300 acres consist of the following land classifications:

a) 21,000 acres of unsuitable land currently in old-growth stages;
b) 31,300 acres of suitable lands currently in old-growth stages.; and
c) 49,500 acres of tentatively suitable lands allocated to an extended rotation prescription managed for old-growth habitat.

Old-growth management minimums have been set for the Kaibab National Forest at fifteen percent.

Due to the lack of inventory information the existing old-growth acres forest-wide can only be estimated by extrapolation of data and professional judgement.

Table 52. Estimated Existing Old-growth Acres by Vegetative Type

Vegetative Type	Total Acres	Estimated Existing Old-growth
Tentatively Suitable:		
Ponderosa pine	355,563	17,859 - 35,718 (5-10%)
Mixed conifer	134,644	13,526 - 20,288 (5-10%)
Unsuitable:		
Ponderosa pine	175,285	15,197 - 33,773 (9-20%)
Mixed conifer	7,334	652 - 1,450 (9-20%)
Pinyon-juniper Woodland	786,036	102,834 -137,113 (15-20%)

In most areas across the Forest adequate old-growth exists above the level to maintain viable populations. With past practices on the south side of the Kaibab, the amount of old-growth characteristic habitat is deficient. With an increase in extended rotation acres Forest-wide and continued implementation of integrated stand management, deficiencies in the distribution and abundance of old-growth characteristic habitat will improve. The short-term effect will be only on stands currently meeting or close to meeting old-growth characteristics in which harvest is deferred. The long-term effect will provide a balance of age classes and habitats. Old-growth dependent wildlife species should experience improved distribution and abundance.

In 1984 the Forest provided 170,700 wildlife and fish user days (WFUD'S) of recreation. Of this total, 87,700 WFUD's were for hunting of which 53,400 were for big game. There were 17,600 WFUD's for fishing and 85,400 for non-consumptive wildlife use.

Threatened and Endangered Species. The Endangered Species Act of 1973 as amended requires that federal agencies protect and manage threatened and endangered animal and plant species and their habitats and work towards their recovery. Table 53 shows the animals and Table 54, the plants that are listed, candidates, or managed as sensitive by the Forest Service. Definitions of terms are contained in the glossary.

Table 53. Animal Species That Are Listed, Candidates, or Managed as Sensitive by the Forest Service

	Species Status	Habitat Location
Apache trout	Federal list Threatened State List - Group 3	North Canyon Creek Introduced population
Peregrine falcon	Federal List Endangered State List - Group 3	Known area on Forest Scattered sightings
Bald eagle (northern)	Federal List Threatened State List - Group 2	Winter population 8-30 birds
Osprey	State List - Group 3	Summer nester (3), Winter visitor
Gray catbird	State List - Group 3	Winter visitor Transient sightings
Baird's sparrow	State List - Group 3	Accidental transient
Snowy egret	State List - Group 4	Rare transient at marshes
Spotted owl	State List - Group 4 Federal List Candidate	Very Rare Resident 3 sightings, 1 nest
Black-billed magpie	State List - Group 4	Accidental North Kaibab
Pine grosbeak	State List - Group 4	Uncommon to rare resident on North Kaibab, May breed
Swainson's hawk	Federal List Candidate	Uncommon to common summer resident, transient
Ferruginous hawk	Federal List Candidate	Uncommon transient
Mountain plover	Federal List Candidate	Rare transient
Spotted bat	Federal List Candidate	Rare resident
Arizona pocket mouse	Federal List Candidate on Tusayan and North Kaibab (Trapped 1980)	Rare resident

Table 54. Plant Species That Are Listed, Candidates, or Managed as Sensitive by the Forest Service

Species	Status	Habitat
Astragalus cremnophylax	Candidate	Limestone outcrops
Camissonia exilis	Candidate	P-J Savannah
Cimicifuga arizonica	Candidate	Bill Williams Mountain
Pediocactus paradinei	Candidate	P-J woodland
Pediocactus peeblesianus var. *fickeiseniae*	Candidate	Gravely hilltops (Marble Canyon)
Argemone arizonica	Candidate	Pine forests
Camissonia confertiflora	Candidate	Unknown
Castilleja kaibabensis	Candidate	High elevation meadows
Chrysothamnus molestus	Candidate	P-J woodland
Clematis hirsutissima var. *arizonica*	Candidate	Rocky ledges, high elevation meadows
Coryphantha missouriensis var. *marstonii*	Candidate	P-J fringe
Erigeron pringlei	Candidate	Cliff ledges and rock crevices
Primula hunnewellii	Candidate	Seeps and ledges
Rosa stellata	Candidate	Fringe pine
Silene rectiramea	Candidate	Grand Canyon rim
Talinum validulum	Candidate	Grand Canyon rim
Aquilegia desertorum	Sensitive	Seeps and springs < 7000'
Carex scirpoidea var. *curatorum*	Sensitive	Seeps and springs >7000'
Flaveria macdougallii	Sensitive	Along Colorado River Canyon
Haplopappus cervinus	Sensitive	Grand Canyon
Haplopappus salicinus	Sensitive	Grand Canyon
Penstemon virgatus ssp. *pseudoputus*	Sensitive	Open areas > 7500'
Potentilla multifoliolata	Sensitive	Rocky drainages (Basalt)

Aquatic and Riparian Areas. Surface water and its associated riparian areas are extremely limited on the Forest. There are approximately 4.5 miles of perennial stream habitat and thirteen reservoirs and tanks supporting fisheries. These areas provide recreational opportunities, although fishing is limited to a put-and-take program. There are 26 miles of identified floodplains and 985 acres of wetlands (includes streams, lakes and earthen tanks).

Riparian communities found in defined areas surrounding springs, streams, lakes,and dirt tanks provide high-quality recreation areas, productive wildlife habitat, and water quality protection. Currently, many problems (notably overgrazing and excessive recreation use) exist in these areas.

The plant communities are characterized by a lack of age class distribution and species composition diversity. The implementation of grazing management systems is expected to help the enhancement of riparian areas, but these areas must be protected in other ways if they are to be maintained and improved.

Grand Canyon National Game Preserve. An area of what was at that time part of the Grand Canyon Forest Reserve was designated in 1906 as a Game Preserve. Subsequently, a large area was deleted through the creation of the Grand Canyon National Park, but the designation remains on 612,736 acres of National Forest. This area, which comprises most of the North Kaibab Ranger District has an interesting history associated with the management of mule deer. The original designation was for the purpose of protecting the herds of mule deer that were commonly seen in the open parks of the Kaibab Plateau. Protection consisted of prohibiting hunting, trapping, or killing of deer, and removal of predators. These actions, along with other management and ecologic factors, resulted in the notorious deer irruptions and dieoffs of the 1920's and 1950's. Some of the efforts to deal with the buildup of deer in the 1920's included attempts to collect fawns and ship young deer to other locations, an abortive attempt at driving deer to other locations, and controversial killing of deer by government hunters and then by sportsmen licensed by the Forest Service. The latter action resulted in a court decision [Hunt vs.United States, 1928] that affirmed the federal government's right to control deer populations, but which required that any hunting by sportsmen also conform to State laws regulating the taking of game. These early management efforts, and their controversial aspects, greatly increased the interest in scientific game management throughout the United States, and gave impetus to the evolution of game management in Arizona. In 1929 the Arizona Game and Fish Commission was established, and shortly thereafter, the Forest Service and Game Commission entered into a cooperative agreement for the taking of deer on the North Kaibab by Arizona sportsmen under permit from the Forest Service and the State.

The area designation as a Game Preserve is in addition to its status as National Forest. Legal direction for management of the Game Preserve is not very specific. Under 16 USC 684-687 the Game Preserve is "set aside for the protection of game animals and birds" and is "to be recognized as a breeding place therefore". In addition, "hunting, trapping, killing, or capturing of game animals and birds...[is] unlawful, except under such regulations as may be prescribed...by the Secretary of Agriculture". 36 CFR Part 241 specifies that the Chief of the Forest Service may enter into cooperative agreements with State game and fish departments for wildlife protection and for securing and maintaining desirable populations of wildlife species. The same regulation also provides that until a cooperative agreement is reached with the State, that persons desiring to hunt or take game or non-game animals on a game preserve shall procure in advance a permit from the Forest Supervisor. Essentially, neither the law authorizing establishment of the preserve, nor the regulations of the Secretary applying to preserves guide wildlife habitat management or other resources on the area, but merely establish federal jurisdiction over the wildlife in the area. Other federal acts, such as the Multiple Use-Sustained Yield Act of 1960, The Endangered Species Act, The Sikes Act, and the Fish and Wildlife Conservation Act of 1960 provide the direction regarding management of wildlife and coordination of wildlife needs with other resource uses, both within the Game Preserve and on other National Forest lands.

The Forest Service recognizes the long-standing public interest in the Game Preserve as well as its legal status. Under the present cooperative agreement between the Arizona Game and Fish Commission and the Forest Service, deer hunting is authorized under State regulation but deer hunters are assessed a fee which is applied to habitat improvement. The Forest and the Commission agree on specific projects within the confines of the deer habitat. In addition, the parties cooperate in development of wildlife management plans, research, use of facilities, game transplants, habitat studies, management of the hunts, and in environmental assessments. Because of the

interest in the area, the Forest Service also cooperates with universities, sportsmen's groups, and other agencies in studying and developing wildlife on the area. In addition, the Forest places special emphasis on budgeting and staffing for wildlife projects.

Legal opinions, as well as an Interior Board of Land Appeals decision (upheld by the U.S. District Court) recognize that the Game Preserve status precludes entry under the mining laws for locatable minerals. Because of this, the area has not been withdrawn under the provisions of 43 USC 1714, but is shown on public records as "closed to mining entry". The area is, however, open to leasing and there have been permits over the years for removal of mineral materials as well as oil and gas leases. Such leases are issued under stipulations that recognize specific wildlife habitat concerns and protection needs.

Future Trends. Projected future use for wildlife and fish consumptive and non-consumptive activities will increase from 170M WFUD's in 1984 to 500M WFUD's in 2030. Accelerated efforts in habitat improvement and coordination with other resources and wildlife management agencies have the potential to increase the supply of wildlife and fish to 250M WFUD's by the year 2030. The current direction alternative would provide approximately 35 percent of projected demand in 2030.

Lands

Special Uses: The Forest accomodates public and commercial uses of National Forest System lands through the issuance of land use agreements and special land use permits. Non-recreation special uses include electronic sites, roads, water transmission facilities, wells, fences, powerlines, telephone lines, sanitary landfills, residences and airport facilities. Recreation special uses include recreation residences (summer homes), commercial concession facilities (resort motels, campgrounds and ski areas) and outfitter-guides (guided sight-seeing and hunting trips). Applications for special uses are approved and permits are issued if the use is determined to be in the public interest and compatible with Forest management goals and objectives. The Forest currently administers approximately 400 special use and mineral permits encompassing 11,400 acres and over 700 miles of linear rights-of-way. Over $113,000 in permit receipts are returned annually to the National Treasury for all special land use permits.

Annual field inspections of special use permits are generally limited to those involving large investments (resort lodges, electronic sites, etc.) and those that have the potential to create resource damage if left in non-compliance with permit terms and conditions (roads, sanitary landfills, etc.). All permit files are reviewed annually for payment of fees and termination dates. Permit fees, based on minimum established rates or available market data, are adjusted when permits or grants are amended or reissued.

As communities within and adjacent to the Forest continue to grow, requests for public and commercial uses of the National Forest will increase, placing greater demands on the existing organization for timely processing, preparation and administration of land use agreements and special uses.

Land Exchange and Acquisition. Included within the Forest boundary are private lands, State owned lands and several communities and rural subdivisions. This land ownership pattern creates many administrative problems on the National Forest. Opportunities exist through land exchange, purchase and donation procedures to alleviate these problems.

The land exchange program operates under several authorities and is the primary procedure used to make adjustments in the land ownership pattern. The lands offered by the United States in a land exchange are tentatively classified as base-in-exchange. Currently, the Kaibab contains 4,875 acres of lands classified as base-in-exchange. In identifying these lands, the Forest Service considers the following criteria: 1) lands needed for community development; 2) small parcels intermingled with mineral or homestead patents; 3) parcels that will serve a greater public need in state, county, city or other federal agency ownership; 4) parcels isolated from other National Forest System lands that are unused, under-utilized or require excessive development or administrative cost; 5) lands under special use permit and no longer desirable for public use; 6) occupancy trespass cases involving substantial structural improvements or within the purview of the Small Tracts Act (PL 97-465); 7) lands that are inconsistent with National Forest purposes; 8) provide for consolidation of public lands; and 9) to improve management, benefit specific resources or increase management efficiency.

Because local and physical conditions may change during the life of this Plan, the lands classified in the Plan and others that may be considered will meet one or more of the above criteria.

Lands suitable for acquisition to the National Forest System are classified by desirability class. Table 55 displays the acreage of land desirable for acquisition by ranger district. Lands desirable for acquisition are identified based on the following criteria:

D1 - Priority 1 Acquisition: 1) lands having endangered or threatened fish, wildlife or plant species habitats; 2) important big game habitat areas; 3) lands having unique historical or cultural resources, when these resources are threatened by change in use or when management may be enhanced by public ownership; 4) lands primarily of value for outdoor recreation purposes and lands needed for protection of visual resource values; 5) lands that ensure access to public lands and resources; 6) lands that increase the resource outputs of the National Forest; 7) wetlands and riparian areas; 8) lands that meet administrative needs or research needs; and 9) lands that meet the needs of programs prescribed by Congress.

D2 - Priority 2 Acquisition: 1) key tracts that are not urgently needed but will promote effective resource management and meet specific needs of sustained-yield management, valuable watershed management, research, public recreation or other defined resource management emphases; 2) lands needed to protect resource values by eliminating or reducing fire risk, soil erosion and occupancy trespasses; and 3) lands needed to lower administrative costs by eliminating or reducing title claims, special uses, road and trail rights-of-way grants and easements.

D3 - Priority 3 Acquisition: 1) lands needed to block in or consolidate existing Forest lands and reduce the miles of interior boundaries and number of interior corners; and 2) lands that maintain or stabilize the economics of local government.

Table 55. Lands Desirable for Acquisition

Ranger District	Acres
Williams & Chalender	13,121
Tusayan	2,598
North Kaibab	209
Total	15,928

Over the last 10 years, the Forest has acquired over 3,700 acres and conveyed approximately 1,300 acres into private ownership through land exchange procedures. With the exception of the Tusayan area, land exchange activity levels are not expected to deviate significantly from past activity levels. Land exchange inquiries for the Tusayan area will increase because of the limited private land base and the need for community expansion.

The purchase program results from the Land and Water Conservation Fund Act (L&WCF) which provides for acquisition of lands within the following categories: 1) Congressionally designated areas; 2) lands within and adjacent to wilderness areas; 3) threatened and endangered species habitat; and 4) recreation acquisition composites. The Forest has not acquired any land under the purchase program, however, several tracts have been identified as having potential for acquisition through L&WCF authorities. These tracts involve lands with high recreation values and unique wildlife habitats that would be important additions to the National Forest.

The following tracts, listed in Table 56, have been identified as eligible for acquisition with L&WCFA funds by this plan.

Table 56. Potential L&WCF Acquisitions

Tract	Legal Description	Acres	Purpose for Acquisition
Snake Gulch	T38N, R3W, Sec 32 & 33 T37N, R3W, Sec 4	140	Wilderness
Sunflower Flat	T20N, R3E, Sec 11 & 12	160	Wildlife
Bull Basin	T24N, R5E, Sec 28	160	Recreation
Tule	T19N, R3E, Sec 9	160	Recreation

Rights-of-Way. The intermingled public and private lands within the boundary of the Forest create many access problems. These problems are becoming more critical as demands for the use of the National Forest increase. Rights-of-way are acquired by case priority for timber, recreation, range, minerals and other resource management purposes.

The Forest acquires approximately three rights-of-way annually to support various resource management activities. Approximately forty additional rights-of-way involving more than sixty miles of road need to be acquired under existing land ownership patterns to assure adequate access for public and administrative use. The Forest rights-of-way needs are displayed in Table 57.

Table 57. Existing Rights-of-Way Needs

Road No.	Road Name	Legal Description	Benefitting Function	R-O-W Miles
445	Houserock South Canyon	T36N-T38N, R4E	Recreation	11.0
107	Government	T23N, R4E, Sec 25	Timber	0.2
248D	Willis Canyon	T40N-T41N, R1E-R2E	Recreation	11.0
335	Apex	T30N, R2E, Sec 33	Recreation	0.5
335	Griffin	T30N, R2E, Sec 18 & 19	Recreation	1.2
328	Supai Village	T31N, R1E, Sec 13	Recreation	1.0
142	Big Aso	T23N, R2W, Sec 29	Range	0.5
39	Santa Fe Wells	T22N, R2W, Sec 26	Range	1.0
16	Airport/Pronghorn	T22N, R2E, Sec 4 & 9	Range	1.0
605A	Long Jim	T30N, R2E, Sec 24	Lands	0.2
84	Cowboy Tank	T23N, R3E, Sec 8, 17 &18	Range	0.5
87	Road 87	T26N, R4E, Sec 31	Lands	0.7
195	Summit Mountain	T20N, R2E, Sec 12	Lands	0.3
57A	Bear Spring	T20N, R2E, Sec 28	Lands	0.3
730	Ivie	T24N, R3E, Sec 10	Timber	1.2
793	Dent-Sayre	T23N, R5E, Sec 22	Timber	0.5
7	Double A	T22N, R1W, Sec 4	Range	0.3
307	Trash Dam	T30N, R5E, Sec 29 & 30	Range	0.2
2	Little Aso	T23N, R2E, Sec 29	Minerals	0.2
305B	Harbison Bloody	T28N, R5E, Sec 19	Range	0.1
25	Horse Hill	T21N, R4E, Sec 8	Range	0.3
268	Park Boundary	T34N, R1E	Timber	1.5
422	West Side	T39N-T40N, R1W-R2W	Timber	18.0

Utility and Communication Facilities. Utility and communication facilities on the Forest are authorized by special use permit, land use agreement or easement. They include oil and gas pipelines, power lines, telephone lines, telegraph lines and

electronic sites. Table 58 displays the number of miles of major corridors by category and Table 59 the location of existing electronic sites.

Table 58. Miles of Major Utility Corridors by Ranger District

Corridor Type	Williams District	Chalender District	N. Kaibab District	Tusayan District
Gas pipelines	47.8	35.0	0	0
Electric power lines	66.8	84.4	42.9	156.1
Water pipelines	5.4	13.7	40.4	10.0
Telephone lines	42.8	41.3	20.2	2.8
Other	0	0	1.3	1.8

Most of the major utility corridors, displayed on the Forest corridor map, are located in the woodland vegetative type on the southern portion of the Tusayan Ranger District and northern extremities of the Williams and Chalender Ranger Districts.

Utility rights-of-way are consolidated to the extent possible to reduce impacts on other resources. This is accomplished by incorporating any additional clearing needed for new power transmission and distribution lines and gas pipelines into existing utility corridors.

Existing major utility corridors will meet predicted demands for such use in the foreseeable future. However, if the need for the designation of a new corridor does arise, the selected location will attempt to avoid 1) areas with pristine, primitive or semi-primitive ROS classifications, 2) areas with high cultural resource values, 3) important wildlife habitat areas, 4) areas with special land designations such as research natural areas, 5) visually sensitive areas, 6) ORV closure areas, and 7) lands classified as suitable for commercial timber production.

Table 59. Location and Type of Electronic Sites

Site Name	Legal Description	Allowable Acres	Types of Use*
Bill Williams Mountain	T21N, R2E, center of Sec 17	2	Communication
Summit Mountain	T20N, R2E, NW 1/4 Sec 12	2	Communication
High School Hill	T22N, R2E, NE 1/4 Sec 34	15	Broadcast
Signal Hill	T21N, R1E, NW 1/4 Sec 1	1	Communication
Kirsch Hill	T30N, R3E, NE 1/4 Sec 29	2	Broadcast
Cooper Ridge	T39N, R2E, NW 1/4 Sec 32	2	Communication
Jacob Lake	T38N, R2E, SW 1/4 Sec 5	2	Broadcast
	TOTAL	26	

* Communication generally includes low power uses such as microwave and two-way radio facilities that broadcast signals at less than 1000 watts "effective radiated power".

Broadcast includes high power uses typically associated with AM radio, FM radio and TV broadcast facilities.

Communication installations are present on several other sites that are not managed as formal electronic sites. For various reasons such as special land designations, remoteness, lack of year-round access and topographic limitations that preclude

expansion and joint-use capabilities, these sites do not lend themselves for classification as electronic sites.

Joint-use of all electronic sites is encouraged. With the exception of Bill Williams Mountain, existing classified sites provide ample space to accomodate additional users. Electronic site special use applications for Bill Williams Mountain are not approved unless additional equipment can be housed in existing facilities.

Proposals for new electronic sites are evaluated according to service coverage, conformation, accessibility, compatibility with existing electronic uses and other resource management objectives, development costs and future expansion potential. New sites are not located in 1) areas with pristine, primitive or semi-primitive ROS classifications, 2) areas with high cultural resource values, 3) areas identified as base-in-exchange, and 4) ORV closure areas.

Withdrawals. A withdrawal is an order removing specific land areas from availability for certain uses. Generally, restricted uses pertain only to entry under the general mining laws. Past withdrawals on lands administered by the Forest Service have been made under a variety of statutory authorities and Executive and Secretarial Orders. With the passage of the Federal Land Policy and Management Act (FLPMA), all such authority has been repealed, although the withdrawals created by them continue in existence. Future withdrawals must be justified by meeting criteria specified in FLPMA.

Areas protected by existing withdrawals under Forest Service jurisdiction include administrative and recreation sites, roadside zones and game preserves. Existing withdrawals have been reviewed under Section 204 of FLPMA and have been recommended for continuance.

Table 60. Existing Withdrawals

Site Name	Acres
Interstate 40 Roadside Zones	1,798
Bill Williams Mt. Roadside Zone	444
Bill Williams Mt. Winter Sports Recreation Area	800
White Horse Lake Recreation Area	560
Moqui Ranger Station	10
Fredonia Administrative Site	40
Ten-X Campground	478
Kaibab Lake Campground	620
Tusayan Ranger Station	107
Dogtown Lake Campground	400
Cataract Lake Campground	191
JD Dam Recreation Area	480
Three Lakes Game Preserve	80
Lambs Lake Game Preserve	98
Big Springs Administrative Site	124
Spring Valley Ranger Station	110
Camp Clover Administrative Site	190
Hull Tank Administrative Site	240
Grand Canyon National Game Preserve *	612,736
Kanab Creek, Saddle Mt. and Kendrick Mt. Wilderness *	110,870
Total	730,376

* Does not fall under the purview of FLPMA for review.

The Arizona Wilderness Act of 1984 withdrew the newly established Kanab Creek, Saddle Mountain and Kendrick Mountain Wildernesses, containing 110,870 acres, to entry under the mining and mineral leasing laws. The withdrawal of these areas is, however, subject to valid rights established on or before the date of their formal wilderness designation.

The only new withdrawals contemplated are those needed to protect areas with high resource values such as existing and proposed developed recreation sites involving large capital investments, visually sensitive roadside zones, research natural areas, cultural resource areas and unique wildlife habitat areas.

Land Line Location. An accurate, responsive land survey program is essential for all land use functions particularly with the interspersion and development of private lands within the Forest boundary. Where property lines are not well identified, the Forest has increased efforts to establish property lines through accurate boundary surveys. Lost land lines and corners common to other land ownerships are retraced and re-established according to case priority. The Forest continually maintains corner monuments, accessories, boundary lines and survey records.

Under existing land ownership patterns, approximately 300 miles of interior and exterior Forest boundary need to be surveyed in order to complete the land line location program. This could be accomplished by the latter part of the first planning period if annual land line production rates continue at present levels. It is estimated that, after completion of the land line location program, approximately 45 miles of property boundary will need to be maintained every year.

Natural Areas

The Forest currently does not have any established Research Natural Areas (RNA). RNA needs in the vicinity are largely covered by areas in the Grand Canyon National Park. A 300-acre area located east of Williams in Garland Prairie is identified for designation as a RNA. This area represents the Arizona fescue-mountain muhly open prairie bunchgrass vegetative type. A number of sites have been considered Forest-wide and interested and affected parties given opportunity to comment. The area is listed as potential in R-3 Progress Report, Research Natural Area Paper, September, 1984, and a candidate natural area by the State Natural Area Advisory Council. The plan includes designation of the Garland Prairie Research Natural Area in the first planning period. During the first period other opportunities for RNA's both on and off the Forest will be considered. Potential RNA's consideration will be coordinated with other agencies.

Range

A total of 1,268,714 acres of the Forest are classified as full and potential capacity for livestock grazing. Of this total, 790,707 acres are presently classified as full capacity and 478,007 acres are classified as potential capacity. Areas are classified potential capacity because of accelerated erosion, dense tree overstory, very little forage, lack of access, water developments or other range improvements. Approximately 264,183 acres are classified as no capacity for livestock grazing because of steep slopes, rock outcrops and erodible soils. Table 61 shows the acreage breakdown by vegetative type.

Table 61. Acres by Capacity Class for Each Vegetative Type at Present

Vegetation Type	Acres Full Capacity	Potential Capacity	No Capacity	Total
Seral grass	25,404	-0-	-0-	25,404
Ponderosa pine Mixed conifer	400,565	206,696	67,794	675,055
Pinyon-juniper	322,883	270,795	192,358	786,036
Shrub grass	41,855	516	4,031	46,402
Total	790,707	478,007	264,183	1,532,897*

* Does not include 1556 acres of developed recreation sites classified as non-range.

Table 62 displays acres of full capacity range by management intensity levels. This provides an indication of management under current budget levels and the area where more intensive management could correct problems.

Table 62. Area of Full Capacity Acres by Management Intensity

Mgmt. Intensity Level	Number of Acres	Number of Satisfac. Mgt. Acres	No. of Unsatis. Mgt. Acres	Correct By Improved Mgt.[Ac.]	Correct By Adjust Mgt.[Ac.]
A	0	0	0	0	0
B	91,542	91,542	0	0	0
C	162,285	162,285	0	0	0
D	290,849	290,849	0	0	0
E	0	0	0	0	0
U	246,031	0	246,031	52,733	193,298

The current estimated grazing capacity on the Forest is 71,000 animal unit months (AUM's) annually. Permitted use in 1985 was 88,900 AUM's with 62,760 AUM's actually grazed. Approximately 7,500 AUM's grazed annually are by sheep and 1,080 AUM's by bison. The remainder of the AUM's are grazed by cattle and horses. There are 41 allotments, one stock driveway and a bison range on the Forest. Of the 41 allotments, seven are year-long, 25 are summer (May thru October) and nine are winter (November thru April).

There are 4,118 range structures such as fences and water developments that will eventually need replacement. During the 1950's and 1960's a significant area of pinyon-juniper overstory was treated to increase the understory forage production. The pinyon-juniper trees were removed or reduced by cabling, chaining, and pushing. It is estimated that 24,645 acres can be cost-effectively treated.

One of the two herds of bison in Arizona is located on the Forest, in House Rock Valley on the east side of the North Kaibab Ranger District. The area is known as the House Rock Buffalo Range. Antelope and deer are also important in the area.

In 1973, the Double A Wild Burro Territory consisting of 27,189 acres was designated on the Forest, northwest of Williams. Livestock also graze the territory. The objective of burro management on the area is to maintain a biologically sound burro population in balance with native wildlife, permitted livestock, and other resource values. To accomplish this, the area plan provides for maintaining a biologically viable population of at least 22 burros.

Future Trends. Maximum grazing capacity is based on the maximum number of AUM's that could be produced if grazing were emphasized above all other resources. In Period 1 this maximum supply is estimated to be almost 74,700 AUM's per year. By the fifth decade, it is projected that the Forest can sustain 121,153 AUM's annually. The projected future use and demand is 78,000 AUM's annually in Period 1 and 123,000 AUM's annually in Period 5.

Under current management, permitted numbers will be balanced with capacity during the first decade. This allows for vegetative recovery and a gradual increase in capacity and permitted numbers. The trend is toward existing sheep operations to convert to the grazing of cattle. Funding is adequate to reconstruct the existing structural improvements. Funds are inadequate for new structural or non-structural improvements or retreatment of existing forage improvement areas. Any forage improvement will generally be the result of other resource activities, such as fuelwood or timber harvest.

Most of the grazing will occur at higher elevations in the timber types. Because of improved soil-moisture-plant relationship that occurs at the higher elevations the capacity is greater. This is particularly true in the grassland and the ponderosa pine vegetative types. The overstory canopy of pinyon-juniper in the lower elevations will slowly continue to increase with a resultant decrease in understory forage grasses, forbs and browse. Because most of the pinyon-juniper type is critical to wildlife for winter range there may be need to further adjust numbers of livestock grazing in order to provide for current wildlife populations.

RPA range targets cannot be fully met with current management direction. The funds allocated annually for forage improvement are needed for replacement of structural improvements. A shift in management direction to establish and provide for a continuing forage maintenance program is needed.

A change in management direction is needed. Plan alternatives need to provide for:

[1] An integrated range resource system to allocate both domestic grazing and wildlife use of the rangeland vegetative base.

[2] More retreatment of range forage improvements to maintain forage productivity.

Timber and Fuelwood

Suitability Some 492,436 acres have been classified as available and tentatively suitable for timber production on the Kaibab National Forest [Table 63]. This figure was determined in accordance with regulations in 36 CFR 219.14. The procedure is described in the timber section of the AMS document.

Table 63. Land Classification

Classification	Acres
1. Non-Forested land	139,787
2. Forested land	1,394,656
3. Forest land withdrawn from timber production	48,689
4. Forest land not capable of producing crops of industrial wood	685,563
5. Forest land physically not-suitable	167,988
6. Forest land - inadequate information	0
7. Tentatively suitable timberland	492,436
8. Unsuitable forest land	902,220
9. Total suitable forest land	492,436
10. Total National Forest Land	1,534,443

Condition Class Distribution. The forest is currently imbalanced in two condition classes. These are the poletimber and sawtimber condition classes. On the North Kaibab Ranger District, the majority of stands are mature and overmature. On the south side of the Kaibab, the majority of stands are in the poletimber and immature sawtimber condition classes. Under current management, uniform distribution of age classes is not achieved during the planning horizon. Table 64 displays the condition class breakdown for the entire Forest.

Table 64. Acres by Condition Class, Total Suitable Forest

Condition Class	Acres	Percent of Total Suitable Acres
Seedling/Sapling	67,899	14
Poletimber	91,536	18
Immature Sawtimber	81,612	17
Mature Sawtimber	136,966	28
Overmature Sawtimber	77,035	15
Sparse 1/	37,388	8
Totals	492,436	100

1/ Marginally stocked timber stands; Pinus ponderosa/Quercus gambelii and Pinus ponderosa/Bouteloua gracilis habitat types; Management stand age, forty years.

Inventory, Growth, and Mortality. Based on information from the current benchmark and the 1978 forest inventory, total suitable forest inventory is 2,886 MMBF. Annual net growth is 80 MMBF. Based on inventory information, annual mortality is estimated to be 18 MMBF, however more recent estimates range from 20 MMBF to 30 MMBF.

The current average annual allowable sale quantity for the entire Forest in the first decade is 64 MMBF . The highest uniform wood yield from lands suitable for timber production that may be sustained under current management [LTSYC] is 25.078 MMCF/year.

Management Systems. Under current direction, the even-aged system of management is applied. The shelterwood method of regeneration is used to obtain natural establishment of new stands. If natural regeneration is not achieved, then artificial reforestation is carried out.

Present management is designed to maintain an even-flow sustained yield of wood products. The concepts of integrated stand management, implemented through the use of the cutting unit system, are being applied during the preparation phases of timber sale planning.

All sales are presently on slopes less than forty percent. Tractor logging is the only yarding method used. Little interest has been shown in cable logging on lands presently considered technologically not suitable for tractor yarding, due to high costs, limited acres available, and the remoteness of those areas.

Sawtimber and Roundwood. Past sawtimber production is displayed in Table 65. It is anticipated that the present level of demand will increase proportionately to the nation's population growth. Multi-product sales and better utilization of aspen and oak from sawtimber sale areas are also anticipated.

Currently, little interest has been shown for roundwood products from the North Kaibab Ranger District. This situation is not expected to change during the first planning period. Similarly, roundwood has not been utilized from the Tusayan Ranger District. During the first planning period, however, better utilization of roundwood from multi-product sales and intermediate cutting of stands from the Tusayan Ranger District is anticipated.

Intermediate cutting from stands on the Williams and Chalender Ranger Districts have accounted for the total roundwood harvest from the Forest. A high level sustained yield of roundwood from multi-product sales and intermediate cutting is expected through the first planning period on these districts. Past roundwood production is displayed in Table 65.

Table 65. Past Sawtimber and Roundwood Production

Fiscal Year	Sawtimber Volume Sold (MMBF)	Roundwood Volume Sold (MMBF)
1975	90.67	6.45
1976	56.77	3.85
1977	6.00	6.87
1978	67.80	6.82
1979	47.95	7.33
1980	44.44	7.13
1981	74.97	7.61
1982	57.85	2.49
1983	54.62	1.90
1984	82.76	4.12
10-year average	58.38	5.46

Reforestation. Silvicultural prescriptions encourage natural regeneration. Where natural regeneration is unsuccessful, planting is required. During the period 1975 to 1984 the Forest was involved in completing backlog reforestation, amounting to approximately 3,500 acres per year. For the most part, backlog acres have been completed. For Fiscal Year 1986, the Forest is targeted to complete 922 acres of KV reforestation. Beyond 1986, the estimated annual reforestation need is 740 acres per year. Included in this figure are stands with excessive dwarf mistletoe infection, and losses attributable to blowdown and wildfire.

Timber Stand Improvement. The timber stand improvement backlog at the beginning of Fiscal Year 1986 was 18,537 acres. Over the last ten years, approximately two-thirds of the timber stand improvement acres have been funded with appropriated dollars, and the remaining one-third with KV. The total precommercial and release thinning target for 1986 is 3,940 acres.

Tree Improvement. The Kaibab tree improvement program is guided by a ten year plan approved in 1984. The level of involvement in tree improvement is determined by seed zone and tree species. There are three seed zones on the North Kaibab Ranger District, and three seed zones on the south side ranger districts. Seed zones 031, 032, 033, on the North Kaibab and seed zone 130 on the Williams and Chalender Ranger Districts are currently participating at level 4, while seed zone 120 on the Tusayan Ranger District and seed zone 210 on the Williams Ranger District participate at level 1. The level 4 program is limited to ponderosa pine with all other commercial species in level 1.

Level 1 requires that seed be collected from a single tree-seed zone, the origin and source be closely identified, and the identity of the seed and seedlings be maintained. Level 4 is a more intensive level, and has greater potential for returns on investments. Superior trees are identified within a zone and seedling or clonal seed orchards are established from these superior trees. Genetically improved seedlings are produced from the seed orchard and for outplanting in the seed zone.

Selection of superior trees is currently being accomplished on the North Kaibab Ranger District with selection on the south side ranger districts to begin in 1987. Progeny testing is scheduled to begin in the late 1980's. Seed orchard establishment is planned for the 1990's. Genetically superior tree seed should begin to be available shortly after the turn of the twentieth century.

A ten-year supply of seed is maintained for each seed zone. In level 1, all seed is collected from dominant, well-formed trees scattered throughout a single zone. In level 4, 75 percent of the seed supply will ultimately be collected from seed orchards, with the remaining 25 percent collected from dominant, well-formed trees in the seed zone.

Fuelwood. The total present annual harvest of commercial green pinyon-juniper fuelwood is 2 MMBF. This annual harvest level is equal to current demand for commercial green fuelwood.

The estimated total present annual harvest of personal-use fuelwood, including free and paid, is 9 MMBF. This output level is equal to current demand for personal-use fuelwood. This figure includes small sales of green Gambel oak and aspen.

Total demand for fuelwood, commercial and personal, is 11 MMBF per year in planning period 1. The Forest can meet the demand in this period.

In 1985, the Forest implemented a personal-use charge system for fuelwood. Standing dead and down material, with some restrictions is available under this system. Accessible areas containing quality dead and down fuelwood for personal-use are gradually being depleted. Most fuelwood gathering in the past has been limited to roaded areas on slopes less than twenty percent. Quality fuelwood is still available on steep slopes and in unroaded areas, but because of inaccessibility fuelwood gathering is not presently practical there.

The Forest will continue to designate free-use areas for personal-use fuelwood harvest, as well. In general, free-use will be available from less desirable areas where reduction of pre-existing slash is a priority, or where other projects requiring removal of fuelwood material have been scheduled.

Past production of commercial and personal fuelwood is displayed in Table 66.

Table 66. Total Past Fuelwood Production, Commercial and personal-use

Fiscal Year	Total Volume Harvested (MMBF)
1975	2.65
1976	3.33
1977	5.20
1978	6.23
1979	10.99
1980	11.99
1981	12.45
1982	12.27
1983	11.49
1984	11.09
10-Year Average	8.77

Future trends. In the past, the south side districts have offered small sales of green Gambel oak for personal-use. Total volume offered has fluctuated between 25-75 MBF each year. The current average annual sustained yield of green Gambel oak from the south side of the Kaibab is estimated to be 500 MBF per year. The demand for

green oak fuelwood is assumed to be completely elastic. If future demand increases, a higher sustained level of output could be maintained at additional cost.

The Forest has historically offered ten through fifty MBF of green aspen fuelwood per year. The current average annual sustained yield of green aspen for fuelwood or other products is estimated to be 1,800 MBF per year, primarily from the North Kaibab Ranger District. Periodic interest in green aspen for commercial use has been shown, however no firm commitments have been made. Little or no increase in consumption of green aspen is expected within the first planning period.

Standards and guidelines within the alternatives provide for the collection of inventory and growth data adequate to verify or improve current sustained harvest levels and management practices involving fuelwood species.

Insect and Disease

There are currently no destructive insects or diseases at epidemic levels except western spruce budworm. The current outbreak of western spruce budworm began in 1975 on the North Kaibab Ranger District. Since 1975, the southwestern mixed conifer and spruce-fir types have been repeatedly defoliated by this insect. Aerial detection surveys conducted in 1984 revealed light defoliation. These defoliated areas were coincident with areas of past defoliation, 1976-1983.

Current silvicultural treatment for spruce budworm in mixed conifer stands is designed to: 1) open up stands by logging, thinning, and burning; 2) maintain stand densities favoring ponderosa pine; 3) reduce the percentage of true firs and spruce through logging and prescribed burning; 4) regenerate stands by artificial means, where necessary, using Engelmann spruce and ponderosa pine stock; and 5) favor even-aged stands of rapidly growing trees. The objective of the treatments is to reduce stand susceptibility by changing the budworm's habitat and reduce stand vulnerability over time by improving tree condition and vigor.

An infestation of pandora moth on the North Kaibab Ranger District began in 1979. In 1981, approximately 20,000 acres of ponderosa pine forest around Jacob Lake were visibly defoliated. The moth has a two year life cycle and causes defoliation only in the latter year. In 1983, total defoliation was reduced to approximately 25 percent of the 1981 level. Based on the 1984 pandora moth egg mass survey, it was concluded that the outbreak had collapsed and no futher suppression action was warranted.

Though there are no known preventative measures for the pandora moth, aerial application of acephate was demonstrated to be effective in reducing pandora moth larval densities to a level that would prevent heavy defoliation of ponderosa pine trees.

Western pine beetle is causing widely scattered mortality throughout the forest. Trees most susceptible are mature or overmature ponderosa pine. The 1984 aerial survey revealed ponderosa pine mortality amounting to scattered clumps of one to ten trees. Presently silvicultural treatments include removing infested mature and overmature ponderosa pine trees.

Mountain pine beetle is also causing widely scattered mortality. This beetle is of main concern on the North Kaibab Ranger District where numerous outbreaks have occurred in the past. Blackman (1931) studied this insect on the plateau in 1925-1926, and estimated that approximately twelve percent of the ponderosa pine type, totaling 300 million board feet of timber, were killed during the 1916 to 1926 outbreak. Like the western pine beetle, mortality was observed in clumps of one to ten trees. Current silvicultural treatments include reducing tree densities to 100 square feet basal area per acre or less, depending on site index, to prevent outbreaks.

An Ips beetle population buildup in ponderosa pine thinning slash was observed on the south side of the Kaibab in the spring of 1982 and has continued through 1986. This activity has most recently been concentrated in the Round Mountain area of the Williams Ranger District and the Fay Lake to Moritz Lake area of the Chalender Ranger District. Regional forest pest managers noted that this Ips activity may warrant some concern beginning in 1986. Where accessible, salvage logging is recommended. Poletimber pulpwood is utilized to a four-inch top (d.i.b.) and sawtimber to a six-inch top (d.i.b). When Ips problems are anticipated, precommercial thinning is limited to the months of July through December and green slash disposed of as practicable.

A region-wide dwarf mistletoe survey, conducted between 1954-1957 (Andrews and Daniels 1960), indicated that thirty percent of the ponderosa pine stands on the Kaibab

National Forest were infected with dwarf mistletoe. Results from a 1984 survey (Hessburg and Beatty 1985) indicate that mistletoe incidence has increased four percent in the last 25 to 30 years on the forest. Dwarf mistletoe incidence was greatest on the North Kaibab Ranger District, with nearly one-half of the stands infected, and least on the Tusayan Ranger District, with only four percent of the stands infected. Forest-wide, incidence and severity are less than the Regional average.

Estimates from the 1984 survey indicate annual growth losses in sawtimber and pulpwood due to dwarf mistletoe infection to be twenty to thirty million board feet. Little volume loss is due to mortality.

The 1984 survey results indicate a trend of increasing incidence and severity of dwarf mistletoe infection. This trend is attributed to selective harvesting, fire control, and a conservative level of harvest inadequate to resolve the problem on a forest-wide scale.

Dwarf mistletoe incidence is most easily reduced when the stands are regenerated. Since the Kaibab National Forest has most of its dwarf mistletoe infection in sawtimber stands, there is an opportunity to reduce incidence and severity within a shortened time frame. The long-term solution to the problem lies in improving stand management by treating infected stands first. Prescriptions need to reflect a major emphasis of reducing stand Dwarf Mistletoe Ratings (DMR), while trying to reflect stocking, spacing and tree diameter objectives.

Stem, root and butt rots also account for mortality and log defect on the Forest. Defect in ponderosa pine is normally less than ten percent, but mixed conifer species are in excess of ten percent with even higher percentages of defect present in old-growth spruce and fir. These rots also predispose infected trees to other agents, and can remove areas from productive management because they persist in infected stumps.

Future Trends. Periodic outbreaks of the western spruce budworm, pandora moth, Ips bark beetles, or the western pine beetle can be expected to occur in the future. There is an everpresent possibility of serious outbreak of mountain pine beetle on the North Kaibab Ranger District. Many stands are overstocked and there is an imbalance of age classes, with eighty percent of the stands classified as immature and mature sawtimber. As a result, the forest will remain highly susceptible to mountain pine beetle attack.

Unchecked, the dwarf mistletoe problem will worsen and the magnitude of associated growth losses will increase.

In the mixed conifer forest type, stand conditions will remain favorable for spruce budworm infestations for some time. Stands are for the most part, over-stocked and decadent. Current conservative allowable harvests and the exclusion of natural fires maintain forest conditions which favor the budworm.

The continuation of appropriate Integrated Pest Management (IPM) methods, including preventative silvicultural treatments, and suppression programs, that are compatible with other resource values, can reduce potential damage to acceptable levels over time.

Soil and Water

A terrestrial ecosystem survey is almost complete for the Forest. Some of the soil names, however, are subject to change through correlation. Six soil orders are represented on the Forest. The orders are Mollisols, Alfisols, Inceptisols, Entisols, Vertisols and Aridisols with a percent composition of 36 percent, 35 percent, 24 percent, two percent, two percent and one percent respectively. Approximately 70 percent of the soil units mapped on the Forest fall within the orders Mollisol and Alfisol. These soils are moderately deep and deep, fine textured, and strongly developed. The inherent productivity ranges from moderate to high. The orders Inceptisol, Entisol and Aridisol, which make up approximately 28 percent of the Forest, are generally confined to steep and very steep slope inclinations and can be characterized as shallow to deep, coarse to medium textured, weakly developed, and containing in excess of 35 percent rock fragments in the profile. The inherent productivity is generally low for these orders. The remaining two percent of the Forest is represented by the soil order Vertisol. The soils within this order display a high shrink-swell potential and are characterized as moderately deep and deep, fine textured, and weakly developed. The inherent productivity of this soil order is high. However, establishment of vegetation is difficult because of shrinking and swelling.

Currently there are 349,425 acres or 23 percent of the Forest with soil loss rates exceeding the established tolerance. Accelerated soil loss rates are due to past management practices, including over grazing. Under current direction soil loss would decrease by ten percent within the first five decades.

A significant source of soil erosion and subsequent increased sedimentation are poorly located and constructed roads. Under current direction approximately forty percent (775 acres) of the Forest's unneeded roads will be obliterated in the first five periods.

The Forest yields an annual average of 302,700 acre-feet of water. This water yield contributes to three major watersheds: the Verde, Little Colorado, and the Colorado. Approximately 35 percent (106,000 acre-feet) drains into the Verde, five percent (15,200 acre-feet) into the Little Colorado, and sixty percent (181,800 acre-feet) into the main stem of the Colorado River. This water yield includes both streamflow and ground water recharge.

Water is put to beneficial uses, both on and off the Forest. On-Forest uses include domestic stock watering, wildlife watering, fisheries, recreation, road construction, and irrigation. Off-Forest uses include municipal water supplies, recreation, and irrigation. Current water impoundments and their consumptive use for this Forest are shown in Table 3-29 for the three major watersheds. Impoundments larger than 15 acre-feet are White Horse Lake, Cataract Lake, Kaibab Lake, Davenport Lake, Russell Tank, Hell's Canyon Tank, Coleman Lake, J.D. Dam, Santa Fe Reservoir, McLellan Reservoir and Jacob Lake. Table 67 also indicates if the legal basis (water right) for these uses stems from state law or from federal law.

Table 67. Existing Water Impoundments and Consumptive Use for the Kaibab National Forest within the Verde, Little Colorado, and Colorado Watersheds

Watershed	Stock Tanks	Springs	Wells	Current Consumptive Use (Acre-Feet) State Claims	Federal Reserved Claims
Verde	286	27	12	170	3.85
Little Colorado	52	1	—	43	.55
Colorado	308	40	15	182	6.60
Totals	646	68	27	395	11.00

The water consumption from the various users within the National Forest boundary amounts to less than one percent of the total water produced within those boundaries.

Within the next five decades under current management, water yield will range from a low of 299,786 acre-feet per year in period four to a high of 302,653 acre-feet per year in period one. This represents a range of 2,867 acre-feet per year within the first five decades or less than one percent.

Both Coconino and Yavapai Counties have conducted floodplain studies for major drainages and population areas in each county. Complementing these studies the Forest Service identified 100-year floodplains on the Forest. Maps were developed for the Forest from these studies outlining the floodplains and floodways. The only major Forest developments that are located in 100-year floodplains are a portion of the Kaibab Lake Campground and the Chalender Ranger District Office.

For ten years water quality data was collected on important reservoirs and fisheries. Generally, the quality of water produced on the Forest is good and complies with established water quality standards. Problem areas are sewage treatment plants operating sub-optimally, and non-point pollution sources. These problems caused several high coliform counts and occasional increased turbidity. However, the point pollution sources were alleviated with improvements to the existing sewage plants. Suspended sediments will continue to cause local turbidity problems until corrective

measures are taken on the eroded soils within this Forest. Under current direction improvements in non-point pollution will occur, but it represents less than five percent within the first five decades.

The Forest has seven potable water systems consisting of four springs and three wells. Potable water is also provided at fourteen locations by hauling water from Big Springs, Grand Canyon National Park, and Williams. All potable water systems are monitored in accordance with the Safe Drinking Water Act. There are also eighteen waste water systems consisting of sixteen septic tank-leach fields, one evaporative lagoon, and one surface discharge lagoon.

The Bill Williams watershed supplies 100 percent of the water for Williams. However, there is no agreement between Williams and the Forest Service concerning the management of this watershed. The water collection system includes five impoundments with a total capacity of 2,770 acre-feet.

Of the 11 major fifth code watersheds on the Forest, seven are rated in unsatisfactory condition (Table 68). A total of 349,425 acres have been identified with accelerated erosion above the tolerance. That is, the vegetation protecting the soil surface has been removed to the point that erosion is occuring at a rate that will gradually decrease site productivity.

Table 68. Table of Watershed Condition with Priority for Improvement Work

Watershed Fifth Code Number	Name	Watershed WIR	Priority for Condition	Improvement Work
186	Sycamore C.	303	Satisfactory	
096	Cataract/Sp.V.	290	Satisfactory	
094	Kanab Cr.	242	Unsatisfactory	1
092	House Rk/Marb.	188	Unsatisfactory	2
093	N.Rim Colorado	155	Optimum	
095	S.Rim Colorado	137	Unsatisfactory	3
185	Upper Verde	136	Satisfactory	
117	Lee/Cedar	116	Unsatisfactory	4
181	Partridge Cr.	79	Unsatisfactory	5
116	Cedar/Deadman	50	Unsatisfactory	6
088	Coyote Wash	47	Unsatisfactory	7

**Watershed Importance Rating.

The watershed importance rating is derived by adding together scores given for a set of pre-determined criteria. Pre-determined criteria include: downstream water use, such as municipal water supply or irrigation; the presence of threatened or endangered species; off-Forest flood risks; and on-Forest watershed uses such as mining or developed recreation.

Under current direction unsatisfactory watershed condition will drop from a high of 349,425 acres in period one to a low of 232,589 acres by period five. This represents an improvement of 116,836 acres within the first five periods under current, which equates a 33 percent reduction in unsatisfactory watershed condition acres.

The key watershed concern is the gradual but steady loss of site productivity in the woodland and shrub-grassland plant communities. If current direction continues there will be a drop in erosion rates with a corresponding improvement in watershed condition. However, these percentages are not significant enough to bring all fifth code watersheds from unsatisfactory to satisfactory condition.

The maintenance of existing site productivity as well as the reversal of declining productivity in the woodland ecosystems will be a continuing concern of the public and resource managers. Resource prescriptions that have been developed, if implemented, could reduce unsatisfactory watershed condition by 265,690 acres or 76 percent by the fifth period. Correspondingly, soil erosion would drop from the current rate of 2,259

Mtons per year to 1,771 Mtons per year. This improvement in watershed condition represents a 70 percent drop in erosion rates within the woodland ecosystem.

There is the potential to increase water yield by approximately 19,316 acre-feet per year by managing timber stands at a lower growing stock levels. This alternative though, is not feasible when wildlife and other resource management concerns are considered.

Surface water rights necessary to secure water for range and other uses will be difficult to appropriate on the Verde River watershed. On this watershed the severance and transfer of existing rights or the purchase of water rights will be necessary to achieve management goals. New appropriations for the Forest are possible on the Little Colorado and Colorado Watersheds. However, on limestone soils within the woodland zone, trick tanks will be the most effective tool to develop necessary range and wildlife waters. There will be a need to construct 137 stock-tanks with a total consumptive use of 98 acre-feet within the several decades to achieve adequate distribution of waters on the Forest.

Future Trends. Water quality should remain stable or improve slightly by the fifth period. Point pollution sources will, on occasion, contribute fecal coliform counts above state water quality standards. However, with continual upgrading of the Forest's present systems, no long-term impact is seen. Dependent on what prescription level is examined, the real improvement in water quality will be in the non-point sources. The Forest has the ability to improve approximately 15,000 acre-feet of water which has high sediment loadings.

Minerals

Forest Service policy recognizes minerals as important resources to be managed with all other resources. The Forest Service role in minerals management is to ensure coordinated development of the mineral resource under the mineral laws with other resource values and uses. The mineral management objective is essentially the same for all mineral commodities, however, Forest Service authorities and responsibilities do vary according to mineral type.

Locatable Minerals. The Forest administers activities conducted under the general mining law in accordance with the regulations contained in 36 CFR 228. Plans of operation and notices of intent are reviewed and periodic compliance inspections of mining and exploratory operations are made.

Management emphasizes resolving unauthorized activities on mining claims. Most frequently these are residential occupancy and removal of common variety mineral materials that are in violation. Reports and supporting documents are prepared and mineral examinations are conducted on claims where validity is questionable.

The mined areas that need reclamation to improve water quality, visual quality and reduce soil loss are shown in Table 69.

Table 69. Inactive Mined Areas with Environmental Degradation

Mined Area	Legal Description	Acres
Fernow Mesa	T23N, R2W, Sec 24	25
Antolini Hill	T22N, R1W, Sec 19 & 20	25
Cucamonga Junction	T22N, R1W, Sec 10	25
Apex Siding	T30N, R2E, Sec 29	30
Anita Station	T29N, R2E, Sec 16, 17, 19-21, 28 & 29	320
Lambs Lake	T38N, R1E, Sec 13 & 14	20
Rattlesnake Canyon	T20N, R1E, Sec 19, 29, 30 & 32	60
Quarry Tank	T20N, R1W, Sec 2 & 3	20
Cruice Siding	T21N, R2W, Sec 27	100
	Total	625

Leasable Minerals. Oil and gas lease applications are processed in accordance with the 1920 Mineral Leasing Act and Regional directives. The Forest recommends or specifies limited surface use stipulations designed to protect special resources when

inadequate protection is afforded by standard lease stipulations, or USGS regulations and operational instructions.

Saleable Minerals. In-service, commercial, personal-use and qualifying free-use common variety mineral material needs are met from designated material sites located throughout the Forest. Surface resource protection is achieved through the development and strict administration of mineral permit stipulations. Mining plans are developed for material sites to assure adequate restoration of disturbed areas.

Table 70. Mineral Status

Status	Acres	Percent of Total Forest Area
Acquired federal surface and private minerals (reserved and outstanding mineral rights)	2,373	0.16%
Private surface and public domain minerals (mineral rights retained by the government)	983	0.06%
Withdrawn by executive or secretarial order*	6,770	0.44%
Withdrawn by statute*	723,606	47.16%
Public domain surface and mineral estate (open to mineral entry)	800,721	52.18%

* Generally withdrawn to locatable mineral entry only. Includes 612,736 acres of the Grand Canyon National Game Preserve and 110,870 acres of wilderness.

There has been no significant production of energy minerals (e.g., oil, gas, coal and uranium) or locatable minerals (e.g., base and precious metals or other metallic minerals). The only mineral commodity that has a history of stable production from the Forest is Coconino sandstone. Coconino sandstone products are produced primarily from pre-1955 mining claims, but also from permitted areas on lands previously encumbered by mining claims.

Building stone has been produced from the Ash Fork and Drake areas of the Forest since the early 1940's. It has been estimated that at least 75 percent of the total production of dimension stone in Arizona can be attributed to these areas. The current production of Coconino sandstone, approximately 13,000 tons per annum, is relatively stable based on projected building schedules throughout the southwest.

Table 70. Active Mines

Mineral Type	Number of Mines, Quarries and Pits
Saleable (common variety)	47
Locatable	60

The demand for common variety mineral materials other than building stone has generally coincided with road building needs and construction activity in the area. The production of common variety mineral materials, primarily volcanic cinders, is estimated to be over 142,000 tons per annum. Extraction of common variety mineral materials from Forest sources is expected to increase slightly according to projected road building and construction trends. The known reserves of common variety mineral materials is in excess of seventeen million tons, representing over 100-years supply

at present consumption rates. In addition, over 33,000 surface acres have been identified as having potential for extraction of mineral materials which would indicate greater than 6,000 years of additional reserves.

A considerable amount of uranium exploration and development activity has occurred both on and adjacent to the Forest. While most of the development activity has occurred on lands under the administrative jurisdiction of the Bureau of Land Management, there has been an intensive exploration program on the Forest, primarily on the Tusayan Ranger District. This exploration activity can largely be attributed to several discoveries of high grade ore deposits on the Arizona Strip. Recently, one such discovery was made on the Tusayan Ranger District. Exploration of uranium properties is expected to continue, however, the possibility of additional discoveries within the Forest remains highly speculative at this time.

Table 72. Acres of Possible Mineral Occurrence*

Mineral Type	Potential Rating**	Forest Acres
Locatable Minerals		
Uranium	A1	20
	A2	40
	B3	6,600
	B4	125,160
Copper	A4	710
Pozzolan	B3	1,600
Building Stone	A1	4,340
Leasable Minerals		
Oil & Gas	B3	1,280
	B4	296,510
	C5	826,130
Saleable Minerals		
Building Stone	A1	250
	B4	9,050
Cinders	A1	280
	B4	33,740
Sand	A1	10
	B3	50
Clay	A1	60
Limestone	A1	150

* Acreages are not unique between minerals, i.e., two or more minerals may possibly be found on same acreage.

** Letter rating indicates geologic favorability as follows:
A = Demonstrated Favorable, B = Theoretically Favorable, C = Uncertain

Numeric rating indicates expected mineral activity as follows:
1 = Production, 2 = Development, 3 = Exploration, 4 = Prospecting, 5 = Uncertain

On several areas of the Forest there has been considerable exploration for oxide copper which is often associated with a minor content of silver and other metals. Current activity appears to be limited to minor exploration of existing claims.

Approximately 60,000 acres of the Kaibab have been leased for oil and gas. Additionally, there are approximately 70,000 acres of oil and gas lease applications where action is pending, but presently deferred until Forest Plan standards and guidelines are approved. To date, oil and gas prospecting activities have involved various geochemical and geophysical tests with negligible surface disturbance.

Future Trends. Demand trends assume that exploration, development and production of all mineral commodities will continue to increase slightly. The uranium market is currently depressed, but will presumably make a slow recovery. Oil and gas leasing, prospecting and exploration activities will increase and demand for common varieties of mineral materials and building stone will increase with continued population growth and construction in the effected area.

Accessibility for mineral exploration and development is good. The majority of the Forest is open to mineral entry. The transportation system is essentially in-place and provides access to nearly all of the Forest.

Air Quality

Air quality over the Forest is generally good. The major sources of air pollutants from Forest activities are fires (planned and unplanned burning) and unpaved roads (dust).

The Clean Air Act and its 1977 amendments give states most of the responsibility for managing air quality within their borders. The framework for air quality management is the State Implementation Plan. The Forest's role in air quality management is to coordinate management activities with state and federal air quality control efforts, protect air quality related values in Class I wilderness, and make recommendations concerning the impacts of external sources of pollution.

The Forest, except for the portion in Sycamore Canyon Wilderness, has been designated as a Class II air quality area. This designation allows moderate degradation of air quality over baseline concentrations. Sycamore Canyon Wilderness area has been designated as a Class I, where very little degradation of air quality is allowed. However, this area lies within three National Forests, and the Coconino National Forest was assigned the planning responsibility for the entire area. Air quality on the Forest is currently in compliance with the requirements of the Clean Air Act.

The Forest coordinates all prescribed burning with state air quality authorities and plans burn ignition to maximize smoke dispersal, and minimize the chance of smoke concentrations over populated areas. These procedures are in compliance with the State Implementation Plan. Temporary air quality degradation occurs, however, national air quality standards are not exceeded.

Because of its location and the prevailing winds, the Forest is relatively free of external air pollution. The degradation that does occur from external sources, is temporary in nature and is attributed to general urban pollution from the Verde Valley.

Future Trends. Air quality will not be significantly effected by forestry burning if current standards and guidelines are continued. However, the application of these standards imposes a limitation on the maximum amount of burning which can be accomplished annually.

Fire Management

Fire management on the Forest is designed to provide a cost efficient program responding to land and resource management goals. This includes wildfire prevention, presuppression, suppression, fuel management, and use of prescribed fire. The previous fire suppression policy was to extinguish all fires promptly at a reasonable cost.

The fire risk and hazards on the Forest are moderately high and typical of Arizona Forests above the Mogollon Rim. Table 73 shows the major fuel types on the Forest along with the average fire occurrence and acreage burned per year for the 1970-1979 decade.

Table 73. Average Annual Fires and Burned Area by Fuel Type, 1970-1979

Fuel Type	M Acres	Fires	Acres Burned
Ponderosa Pine	532	137.6	195
Mixed Conifer	143	45.9	151
Brush and Grass	61	17.4	46
Woodland (P-J)	788	27.1	10

Resource damage potential from wildfire ranges from very low in the woodland, brush, and grass to very high in the commercial timber and urban interface.

The current annual loss from wildfire is considered to be acceptable and the "Fire Management Analysis" indicates that the current program, although slightly low, is very close to the least cost plus loss program. There appears to be an opportunity however, to increase efficiency even more by relaxing the suppression standards on low resource loss areas.

The current prescribed fire program is approximately 85 percent hazard reduction and fifteen percent vegetation manipulation. The annual accomplishment varies significantly because of weather and funding with a five year average of 3,000 acres per year. All prescribed burning is accomplished by planned ignition.

Past fuel treatment practices have allowed fuel to accumulate to unacceptable levels in many areas of the commercial forest. Recent emphasis in fuels management and increases in fuels treatment funding have minimized increased accumulation and in many areas restored fuel loading to a near natural level.

Future Trends. Fire occurrence, acreage burned, and resource loss will all increase as Forest use accelerates unless the level of prevention and suppression is appropriately increased. If current emphasis and funding of the fuels program continues, the fuel profile should remain fairly stable. With increased utilization and a growing proficiency in the use of prescribed fire, we could see a marked reduction in the area with unacceptable fuel loading by the end of the first planning period. Significant reductions in fuel loading would at least partially compensate for the expected increase in person-caused fires.

FACILITIES AND CORRIDORS

Transportation System

The Forest has 6,691 miles of Forest Development Roads (FDR), which include state and local highways. There are 946 miles of arterial and collector roads and 5,745 miles of local roads.

In the past, timber sales, ranchers, mine operators, and wood cutters have created travelways to serve their particular interests. This left the Forest with many unplanned and unengineered roads. These travelways are included as local roads in the Forest's Transportation Inventory System.

The transportation system is managed by establishing specific objectives based on an evaluation of the forest resources served, administrative needs, and the number and type of Forest users expected. Road management prescriptions are developed based on this analysis. These prescriptions may require complete closure of some roads, seasonal restrictions, restrictions during high use periods, road obliteration, or full service roads that extend the season of use.

Approximately 500 miles of road have been identified for obliteration because of resource damage, safety hazards, or being unneeded for administration or resource access. It is estimated another 500 miles will be identified for obliteration when road management planning is completed in FY 87.

Approximately 1,600 miles of road are machine maintained annually using a combination of appropriated funds, timber purchasers, state and county governments, and other users. Because of limited funds, the emphasis for maintenance is on user safety and resource protection.

All roads are not physically maintained annually. Some roads do not require annual mechanical maintenance to protect surrounding resources or to provide safe access for resources. If drainage is intact, low use roads may remain serviceable for many years with infrequent scheduled maintenance. Other roads are deteriorating and causing resource damage. Maintenance is planned when it has been identified as a high priority to protect resources, provide user safety, or for high use roads.

Table 74. Road Miles by Maintenance Level

Maintenance Level	1	2	3	4	5
Road Miles	87	5419	736	231	218

Various entities maintain different roads on the system under the terms of contracts, agreements or permits.

Table 75. Current Maintenance Responsibility

Responsible	Miles
Forest Service	6,074
Timber Purchaser	125
State	139
County	120
Private/Other	233

There are three bridges and 25 major culverts on the Forest. They are all in fair to good condition.

Many of the Forest Development Roads are approaching the end of their useful life and will require reconstruction or heavy maintenance for continued safe use and resource protection.

Management direction for construction and reconstruction of the road system is to provide minimum road facilities to safely accommodate the expected type and volume of traffic. State and county governments are encouraged to assume responsibility for roads serving private developments.

Less than five miles of new road are constructed annually, primarily for timber sale access, or to mitigate other environmental concerns. These include extensions of existing roads and the relocation of other roads from drainages.

Certain Forest, state, and county roads are designated as Forest Highways. A significant volume of the traffic generated is not associated with forest resources. There is one forest highway on the Kaibab, Forest Highway 1. This is State Route 67 from Jacob Lake to the North Rim of Grand Canyon National Park.

Forest Highway 1 is scheduled for reconstruction within five years. Reconstruction is needed because the subgrade has failed and rendered the road surface very costly to maintain. Also, three curves are planned for realignment and some minor widening is planned for user safety.

Public use of the Forest road system is expected to increase. Public safety and resource protection will continue to be major concerns in transportation system management and planning. At current rates of reconstruction and maintenance, additional roads will fall below standard service levels. These roads will continue to receive limited use until the resultant resource damage or lack of user safety exceeds tolerable limits.

The Forest will continue to transfer jurisdiction and maintenance responsibilities to appropriate agencies whenever possible.

Administrative Facilities

Many buildings and other structures have been constructed or obtained by the Forest over the years to meet administrative needs. The Forest maintains four office buildings, 42 buildings for housing, fifty storage and service buildings, ten lookouts, and 11 miscellaneous buildings. In addition, the Supervisor's Office and the Chalender and Tusayan Ranger District Offices are leased by the government. The Forest also owns 45 trailer houses that are used for housing, offices, storage, and two soils labs. These facilities are located at ten administrative sites and work centers and at the district offices and Supervisor's Office.

The capital investment value of the facilities owned by the government is $2,805,000. Many of these buildings are old and substandard for needed services. The capital investment program reqired to improve facilities and meet administrative needs will increase the capital investment value to $8,646,000. This ongoing program would correct the deficiencies for all ranger districts.

There are seven potable water sources on the Forest developed for administrative use consisting of four springs and three wells. There are fourteen additional water systems that use hauled water and three systems that have pipelines to other sources. All water systems are currently in good condition.

Two solid waste disposal sites exist on the Forest. One at Tusayan, operated by Coconino County, serves the community of Tusayan and surrounding areas. Williams operates a disposal site on the Chalender Ranger District in cooperation with Coconino County. Other than possible future replacement of these solid waste sites, no new sites are anticipated for the Forest.

There are nine dams on the Forest, and all are in fair condition. Three are under special use permits to the City of Williams for municipal water supply. The Forest operates and maintains six dams for recreation, range, and wildlife habitat. See the section entitled Range in this Chapter for a discussion of stockponds and other facilities maintained for range purposes.

The locations of ten sites have been identified to complete the microwave communications system on the Forest. The proposed microwave sites are:

Kaibab Supervisors Office;
Bill Williams Mountain;
Tusayan Administrative Site;
Red Butte;
Crazy Jug Point;
Big Springs Lookout;
Dry Park Lookout;
North Kaibab Ranger Station;
Buck Ridge; and,
Jacob Lake Administrative Site.

Maintenance and reconstruction of facilities will continue to be a concern to ensure public and employee health and safety and the protection of investments. The current program does not provide the level of maintenance and reconstruction necessary. Many facilities should be replaced or reconstructed within the next 30 years.

Energy

Energy is consumed in the production of goods and services from the National Forest. Primary consumptive uses are logging, road constuction, recreation and administration of the Forest.

The Forest will continue to experience a large increase in recreation use as well as a slight increase in timber produced. In spite of measures to reduce energy use through more efficient vehicles, the amount of energy consumed will continue to increase.

4. Environmental Consequences

OVERVIEW

Environmental consequences are the effects and impacts of an alternative on the physical, biological, social, and economic environment. Chapter 4 describes the direct and indirect environmental consequences that result from alternatives considered in detail.

Analysis and evaluation of the consequences provide the basis for comparing alternatives. Alternatives considered in detail in developing the Kaibab National Forest Land and Resource Management Plan (Forest Plan) are described in Chapter 2.

Environmental consequences result from applying various combinations of management prescriptions. In each alternative, the mix of prescriptions produces different levels of resource outputs, such as recreation, wildlife habitat, timber and fuelwood production, water yield, watershed condition, and grazing capacity. The differences between the level of outputs, the location of their production, and timing results in distinct environmental consequences. This mix represents the short-term use of the environment.

Environmental consequences for all alternatives are limited to some extent because of standards and guidelines imposed to ensure long-term productivity of the land. These standards and guidelines are described in the Forest Plan in Chapter 4. The alternatives considered in detail do not significantly reduce long-term productivity. Chapter 5 of the Forest Plan contains the monitoring requirements that determine if long-term productivity is being maintained while meeting the goals and objectives.

Predicted outputs and effects for the planning period were developed using FORPLAN. Additional detail on predictions of multi-resource interactions for each alternative is included in the planning record.

Environmental consequences are estimated by resource element for each alternative. The effects discussed are the net effects of each alternative on a particular resource. For example, the minerals section displays how the minerals resource is affected by the alternatives and not how other resources may be affected by minerals activities. The discussions reflect the net impact of all the management activities within an alternative and individual effects of various activities are normally not displayed. For example, the effects on soils from an alternative are the net effects from timber harvest, grazing, minerals, and watershed improvement projects. This approach provides a useful evaluation among alternatives.

In some cases, the level of output or activity is displayed as an indication of the environmental effect. In these cases, there is a direct relationship between the level of activity and the environmental consequences of the alternative. For example, displaying a higher timber harvest in one alternative than in another alternative implies a different magnitude of consequences because of the increased level of activity.

Short-term uses are those that occur annually, while long-term productivity refers to the capability of the Forest to continue producing goods and services over the first five decades and beyond. Short-term uses are such practices as timber and fuelwood harvest, recreation uses, livestock grazing, mineral extraction, and special land uses.

Soil and water are the primary resources upon which productivity is based. Short-term uses that damage soils and soil-water relationships impair long-term productivity. Management standards and guidelines provide for protection of long-term productivity by requiring that impacts on soils and water from short-term uses be mitigated and/or that short-term uses enhance soil productivity and water yield and quality.

Irreversible and irretrievable resource commitments are noted where appropriate. These are decisions permanently affecting the non-renewable resources such as soils, minerals, and cultural resources. They represent the future lost production or use of renewable resources and opportunities foregone.

Probable adverse environmental effects that cannot be avoided are discussed where appropriate. Unavoidable adverse effects result from managing the land for one set of resource uses at the expense of the use or condition of other resources. Management

standards and guidelines in prescriptions mitigate most adverse effects by limiting the extent and duration of impacts.

Alternative formulation eliminated alternatives that would have resulted in excessive impacts.

RESOURCE CONSIDERATIONS

RECREATION

Developed Recreation

Developed recreation issues and concerns focus on maintenance levels of existing sites and the opportunities for providing additional developed recreation capacity through the expansion of existing sites and construction of new sites. The alternatives provide for different combinations of management intensity for existing sites and various mixes of new public and private sector recreation investments to address these issues and concerns.

The need for additional camping facilities, snow play areas and picnic areas are amoung the top developed recreation priorities specified for Coconino County in the Arizona Statewide Comprehensive Outdoor Recreation Plan. All of the alternatives provide additional camping and picnic facilities through the construction of new public and private sector sites. Existing snow play areas are managed at standard service level in all alternatives except C. Under Alternative C, less than standard service management of snow play areas will result in declining facility conditions and may eventually lead to the closure of these sites.

Based on analyses of past use, developed recreation projections of future use were established to determine the amount and type of new facilities needed to accomodate projected use above current capacity. The demand projections, displayed in Chapter 3, represent the maximum level of output the Forest could sustain given an unlimited supply of developed recreation capacity. All of the alternatives fall well within the demand projections in terms of projected output and capacity.

With the exception of Alternative A, which represents the current situation, all of the alternatives provide for the construction of additional recreation capacity through the fifth decade. Projected use for these alternatives, displayed in Table 76, fall within a relatively narrow range of outputs, however, the combination and scheduling of investments varies considerably.

Table 76. Average Annual Developed Recreation Outputs in RVD's by Alternative

	Alternatives					
	PA	A	B	C	D	E
Total Developed Use						
Period 1	589,882	537,011	594,900	584,905	589,882	594,900
Period 5	983,553	547,757	1,114,728	1,022,409	1,019,568	1,110,023
Public Sector Use						
Period 1	314,027	314,027	113,463	350,042	216,158	57,001
Period 5	417,002	309,007	270,753	455,858	352,714	209,421
Private Sector Use						
Period 1	275,855	222,984	481,437	234,863	373,724	537,899
Period 5	566,551	238,750	843,975	566,551	666,854	900,602
Percent of Projected Use Satisfied						
Period 1	99%	90%	100%	98%	99%	100%
Peroid 5	66%	37%	75%	68%	68%	74%
Percent of Total Output in Public Sector						
Period 1	53%	58%	19%	60%	37%	10%
Period 5	42%	56%	24%	45%	35%	19%

Table 76. [cont.] Average Annual Developed Recreation Outputs in RVD's by Alternative

	Alternatives					
	PA	A	B	C	D	E
Percent of Total Output in Private Sector						
Period 1	47%	42%	81%	40%	63%	90%
Period 5	58%	44%	76%	55%	65%	81%

All alternatives, except Alternative A, provide sufficient capacity to meet projected use in the first few decades. However, the capability of the Forest to accomodate projected use in the fifth decade is limited by the availability of potential sites with attributes favorable for recreation development. This is of little consequence when viewed in light of the tenure of the plan and the reliability of use projections for the latter planning periods. For the immediate future, projected moderate increases in recreation demand are substantiated from trends based on past use and from predicatable short-term factors such as general economic conditions, energy costs and population which have a direct influence on recreation use patterns. These same factors may vary significantly in the long-term and drastically alter recreation use trends.

Alternatives PA and C essentially maintain the current mix of public and private sector capacity and output reflected under Alternative A. Unlike Alternative A, however, both of these alternatives shift the preponderance of capacity and use in the latter planning periods to the private sector. Alternatives B, D and E result in a dramatic change from the current even mix of capacity and output through the conversion of public sector campgrounds to concession operation, and emphasis on expansion of private sector sites and new private sector recreation investments.

All of the alternatives except Alternative A provide for minor reconstruction of public sector sites within existing site capacities. Reconstruction projects include upgrading substandard facilities to RIM condition class 1.

Table 77. Recreation Investment Schedule by Alternative

Site Name & Capacity	Planning Period Construction or Expansion Occurs by Alternative					
	PA	A	B	C	D	E
Existing Public Sector Site Expansion						
Cataract Lake CG (375 PAOT)	-	-	P2	P1	P2	P2
Ten-X CG (425 PAOT)	-	-	P2	P2	-	P2
Proposed Public Sector Site Construction						
Adams Lake (400 PAOT)	P4	-	P3	P5	P3	P3
Hwy 64 Visitor Ctr (75 PAOT)	P3	-	P2	P5	P4	P2
Big Spr Day-Use (100 PAOT)	P5	-	P2	P5	P5	P2

Table 77. [cont.] Recreation Investment Schedule by Alternative

Site Name * & Capacity	Planning Period Construction or Expansion Occurs by Alternative** PA	A	B	C	D	E
Existing Private Sector Site Expansion						
Moqui Lodge (1,230 PAOT)	P1,2	-	P2	P1,2	P1,2	P2
Moqui RV Park (750 PAOT)	P1,2	-	P2	P1,2	P1,2	P2
Jacob Lake Inn (500 PAOT)	P1,2	-	P2	P1,2	P1,2	P2
Kaibab Lodge (225 PAOT)	P1,2	-	P2	P1,2	P1,2	P2
Proposed Private Sector Site Construction						
Grandview CG (400 PAOT)	P1	-	P3	P5	P1	P3
DeMotte II CG (400 PAOT)	P2	-	P2	P5	P2	P2
Orderville Cnyn (400 PAOT)	P3	-	P1,3	P5	P3	P1,3
Bill Wms Ski Area (2,000 PAOT)	P1	P1	P1	P1	P1	P1

* Total capacity of site after expansion or construction measured in PAOT's which represents the number of people that can comfortably use or occupy the site at one time.

** P1 - Denotes full expansion or construction in planning period 1, P2 in planning period 2, etc.; P1,2 - Denotes phase expansion or construction in planning periods 1 and 2, P1,3 in planning periods 1 and 3, etc.

Several proposed sites in Table 4-2 merit further explanation. Construction of the public sector Adams Lake campground is predicated on the development of Adams Lake, a municipal water storage facility proposed by the City of Williams. The Bill Williams ski area is shown constructed in planning period 1 under all alternatives. The impacts associated with this proposal are evaluated and addressed in a separate EIS, approved on June 13, 1985 and subsequently appealed. The allocation of the north slopes of Bill Williams Mountain for a new alpine ski development was analyzed and made outside the land management planning process. The construction of a new ski area serving up to 2,000 skiers at one time is dependent on the issuance of a prospectus and receipt of an acceptable development proposal.

Table 78. Additional Site Capacity in PAOT's from Recreation Expansion and Construction Projects by Alternative

Planning Period	Alternatives PA	A	B	C	D	E
Public Sector Capacity						
Planning Period 1	0	0	0	285	0	0
Planning Period 2	0	0	535	75	285	535
Planning Period 3	75	0	400	0	400	400
Planning Period 4	400	0	0	0	75	0
Planning Period 5	100	0	0	575	100	0

Table 78. [cont.] Additional Site Capacity in PAOT's From Recreation Expansion and Construction Projects by Alternative

Planning Period	Alternatives PA	A	B	C	D	E
Private Sector Capacity*						
Planning Period 1	1475	0	400	1075	1475	400
Planning Period 2	1150	0	2225	750	1150	2225
Planning Period 3	400	0	400	0	400	400
Planning Period 4	0	0	0	0	0	0
Planning Period 5	0	0	0	1200	0	0
Total Additional Site Capacity	3600	0	3960	3960	3885	3960

* Excludes the 2,000 PAOT's which would result from the construction of the Bill Williams ski area.

As shown in Table 78, all alternatives except Alternative A rely heavily on the private sector to provide the additional capacity needed to satisfy projected developed recreation demand. Private sector investments are greatest in the first few planning periods under Alternatives PA, B, D and E. Alternative C postpones the construction of several private sector sites until the fifth decade. New public sector sites are scheduled in the early planning periods under Alternatives B, C, D and E. Public sector investments are deferred in Alternative PA to the latter planning periods to reduce Forest Service construction and maintenance costs.

The alternatives provide for various combinations of management schemes for individual recreation sites in terms of maintenance levels and options for private sector operation and maintenance of government-owned campgrounds. Maintenance of developed recreation facilities are described by standard service level and less than standard service level in Table 79. Private sector sites are all operated and maintained at standard service level according to terms and conditions of special use permits. All proposed public sector sites are also managed at standard service level. However, maintenance levels of existing public sector sites vary by alternative.

Alternatives PA, B, D and E operate and maintain essentially all public sector sites to standard service level. To accomplish this, however, Alternatives B, D and E convert several public sector fee sites to concession operation. Alternatives PA and C are the only alternatives that provide for Forest Service operation and maintenance of all public sector sites. Under these alternatives, Cataract Lake recreation area is evaluated for cooperative management and development opportunities with Coconino County under special use permit.

Alternatives A and C maintain some sites to less than standard service level. This may ultimately result in the closure of certain facilities and sites if conditions fall below minimum health and safety standards. Under Alternative A, several public sector fee sites, campgrounds where overnite use fees are charged, are managed at less than standard service level. Public sector recreation fee sites are one of several revenue producers for the Forest Service. Less than standard management of public sector fee sites may eventually lead to the deterioration of these sites below standards which qualify them for fee collections. Under Alternative C, visitor information centers, snow play areas and scenic overlooks are managed at less than standard service level. Even though these facilities are non-revenue producers, they are essential to provide a wide spectrum of developed recreation opportunities.

Table 79. Management Intensity of Public Sector Recreation Sites by Alternative*

Recreation Site	PA	Alternatives A	B	C	D	E
White Horse Lake CG	STD	LSTD	PVT	STD	STD	PVT
Dogtown Lake CG	STD	STD	PVT	STD	STD	PVT
Kaibab Lake CG	STD	LSTD	PVT	STD	STD	PVT
Cataract Lake CG	STD	LSTD	STD	STD	STD	STD
S.Kaibab OtherSites	STD	STD	STD	LSTD	STD	STD
Ten-X CG	STD	STD	STD	STD	PVT	STD
Jacob Lake CG	STD	LSTD	STD	STD	PVT	PVT
DeMotte CG	STD	LSTD	PVT	STD	PVT	PVT
Indian Hollow CG	STD	LSTD	STD	LSTD	STD	STD
N.Kaibab OtherSites	STD	STD	STD	LSTD	STD	CLSD

* STD - Standard service level - Management objectives are designed to enhance visitor experience and convenience by limiting use to design capacities, providing for regular maintenance of facilities, providing for visitor information services and operating sites based on seasonal demands.

LSTD - Less than standard service level - Management objectives are designed to prevent resource degradation of developed sites by limiting use to design capacities, providing for regular maintenance of facilities, providing reduced levels of visitor information services and operating sites based on minimal seasonal demands. Some facilities may be temporarily closed due to substandard conditions. Occasional "over use" of sites may occur.

PVT - Private sector operation and maintenance of government-owned sites. Concession permittees are required to operate and maintain sites to standard service level. A percent of gross receipts are returned to the Forest Service for the business privilege.

CLSD - Closure of facilities.

The alternatives display distinct differences in terms of costs, revenues and overall economic efficiency. Economic indicators for the alternatives are shown in Table 80.

Table 80. Developed Recreation Economic Indicators by Alternative

Economic Indicator	PA	Alternatives A	B	C	D	E
Cumulative PNV, Assigned Values	$172,531	$101,681	$191,425	$167,616	$179,237	$191,158
Cumulative PNV, Actual Cash Flows	$5,574	$979	$4,988	$6,399	$4,569	$4,535
Average Annual Operation and Maintenance Costs						
Planning Period 1	$254,612	$224,077	$173,288	$253,672	$212,437	$137,618
Planning Period 5	$301,704	$190,533	$235,764	$281,544	$259,211	$199,999
Average Annual Forest Service Investment Costs						
Planning Period 1	$13,247	0	$5,299	$26,127	$7,065	$3,091
Planning Period 2	$13,247	$21,852	$52,980	$21,734	$19,945	$50,772
Planning Period 5	$28,082	$33,544	$12,365	$83,269	$23,225	$10,157

Table 80. (cont.) Developed Recreation Economic Indicators by Alternative

Economic Indicator	Alternatives PA	A	B	C	D	E
Total Average Annual Developed Recreation Budget						
Planning Period 1	$267,859	$224,077	$178,587	$279,799	$219,502	$140,709
Planning Period 5	$329,786	$224,077	$248,129	$364,813	$282,436	$210,156
Percent Change from Current Total Developed Recreation Budget						
Planning Period 1	+20%	0%	-20%	+25%	-2%	-37%
Projected Annual Recreation Receipts						
Year 1990	$367,901	$298,262	$244,151	$392,794	$278,390	$199,546

Alternatives PA and C have the highest average annual developed recreation budget, primarily a result of higher maintenance levels of existing public sector sites. Public sector investment costs are highest in the early planning periods under Alternatives B, C and E. Alternatives B, D and E provide for total recreation budgets below the current level, reflected under Alternative A. Reduced costs for these alternatives are a consequence of converting public sector sites to concession management.

Projected recreation receipts are significantly higher under Alternatives PA and C. Alternatives B, D and E result in projected revenues below the estimate for the current management alternative.

The relationship of maintenance levels, investment schedules and concession management of public sector sites to overall economic efficiency are best reflected in the present net value calculations (PNV) for each alternative. A PNV using assigned values and a PNV based on actual cash flows alone were computed to display the relative economic merits of each alternative. Both the assigned value PNV and cash flow PNV for Alternatives PA, B, C, D and E fall within a relatively narrow range. However, Alternatives B, D and E which have the highest assigned value PNV rank lower in the PNV calculations based on cash flows. This is primarily a result of foregone cash receipts from the private sector operation of government owned campgrounds. Alternatives PA and C show the highest PNV based on actual cash flows. Both the assigned value PNV and cash flow PNV are lowest under Alternative A.

Impacts to other resources from the operation and maintenance of developed recreation sites and construction of new sites are insignificant. Capacities of existing and proposed developed sites located adjacent to water impoundments are set to ensure preservation of water quality. The acreage of proposed recreation sites removed from commercial timber production are negligable when viewed in light of the total suitable land base. Proposed recreation sites do not exhibit unique or special wildlife habitat values. Specific resource impacts from the construction of proposed recreation sites are assessed in accordance with NEPA requirements prior to site concept design preparation and project implementation.

Irreversible and Irretrievable Commitments

There are no irreversible commitments of resources from developed recreation in any planning alternatives. Table 81 displays irretrievable commitments attributed to foregone recreation receipts and lost opportunities in developed recreation output for each alternative for the first planning period. Alternatives that utilize a less than standard operational level may result in the degradation and eventual loss of capital investment facilities. Irretrievable commitments of timber volumes lost through the construction of proposed recreation sites scheduled for the first planning period are negligible.

Table 81. Irretrievable Developed Recreation Commitments by Alternative for Planning Period 1

Irretrievable Commitment	Alternatives PA	A	B	C	D	E
Average Annual Output (RVD's)	589,882	537,011	594,900	584,905	589,882	594,900
Difference in Highest Annual Output (RVD's)	5,018	57,889	0	9,995	5,018	0
Difference in Highest Revenues for Year 1990	$24,893	$94,532	$148,643	0	$114,404	$193,248

With the exception of Alternative A, projected developed recreation outputs lost through reduced site development opportunities are insignificant. However, there are dramatic differences in foregone revenues by alternative. Alternatives A, B, D and E result in fewer cash receipts for several reasons including reduced public sector capacity due to declining site conditions, concession management of public sector campgrounds and emphasis placed on private sector investments in lieu of public sector site development. Under Alternative PA, foregone revenues are a consequence of deferred public sector site investments in the early planning periods.

Dispersed Recreation

The alternatives address dispersed recreation issues and concerns by providing for various investment opportunities, ORV closures and maintenance levels of recreation roads, trails and popular dispersed camping areas.

The Arizona Statewide Comprehensive Outdoor Recreation Plan identifies the desire for additional hiking trails and trailhead facilities, cross country ski opportunities and ORV closures in the Coconino County assessment area. With the exception of Alternative A, all of the alternatives satisfy these desires to a certain extent.

Recreation outputs have little relevancy to issues and concerns related to dispersed recreation. As shown in Table 82, dispersed outputs do not vary greatly by alternative. However, the capability of the alternatives to provide a variety of recreation opportunities is reflected somewhat by the difference in projected outputs for each alternative.

Although projected outputs are similar for all alternatives, they are influenced by certain management practices under several alternatives. Reduced outputs under Alternatives A, D and E are a result of fewer dispersed investments or decreased levels of road maintenance in the roaded natural.

Most of the coniferous forest land area is classified as RN and the majority of use occurs within this ROS class under all alternatives. Areas classified as RN also contain the majority of dispersed recreation facilities and generally provide more attractive environmental settings for many recreation activities than other ROS areas. The woodland and shrub grassland vegetative types comprise most of the area classified as semi-primitive and semi-primitive motorized. Although these ROS areas may be less desireable for certain recreation activities, they do provide important opportunities for solitude, big game hunting and gathering of forest products.

No distinction is made between the alternatives by composition or opportunities provided by the various ROS classes. Existing acreages in each ROS classification are maintained under each alternative. Projected use for each ROS class over the planning horizon is well within estimated use capacities. Activities associated with the RN areas have the largest projected demands and the 1,013,194 acres in this ROS class is used well below estimated capacity.

Passage of the Arizona Wilderness Act in 1984 ensured permanent protection of the primitive and semi-primitive portion of the ROS spectrum. Although the capacities of these areas are inherently much lower than RN, projected use of the P, SP and SPM is not expected to approach estimated capacity until the latter planning periods.

Table 82. Average Annual Dispersed Outputs in RVD's by ROS Classification*

ROS Classification	Alternatives PA	A	B	C	D	E
Semi-Primitive (SP)						
Planning Period 1	300	600	400	400	300	300
Planning Period 5	900	700	900	900	800	800
Semi-Primitive Motorized (SPM)						
Planning Period 1	36,700	33,500	36,700	36,700	36,700	36,500
Planning Period 5	55,500	50,000	55,500	55,500	55,500	54,900
Roaded Natural (RN)						
Planning Period 1	242,200	220,700	241,600	242,100	218,300	217,500
Planning Period 5	369,700	328,100	366,900	364,500	324,300	329,400
Total Use All ROS Classifications						
Planning Period 1	279,200	254,800	278,700	279,200	255,300	254,300
Planning Period 5	426,100	378,800	423,300	420,900	380,600	385,100

* Dispersed recreation use projections exclude projected average annual highway use of 691,800 RVD's and use associated with wildlife activities.

Relative small amounts of dispersed recreation use in the P, SP and SPM, large unused capacities in these ROS areas and wilderness designation of lands at the primitive end of the ROS spectrum eliminate the need and desirablity for adjusting ROS acreages.

The alternatives display distinct differences in their capability to influence the overall recreation experience. These differences can be illustrated by the relative proportion of funding for maintenance of popular dispersed areas, hiking trails and recreation roads as shown in Table 83.

Table 83. Average Annual Dispersed Recreation Operation and Maintenance Budget for Planning Period 1 by Alternative

	Alternatives PA	A	B	C	D	E
Area Maintenance	$65,802	$47,480	$65,528	$65,677	$59,500	$58,240
Road Maintenance	$79,281	$78,784	$79,111	$79,290	$65,884	$60,582
Trail Maintenance	$4,114	$3,445	$4,102	$4,111	$3,872	$3,146
TOTAL MAINTENANCE	$149,197	$129,709	$148,741	$149,078	$129,256	$121,968

Total dispersed operation and maintenance funding for Alternatives PA, B and C is essentially the same. These alternatives provide for total maintenance financing above the current level reflected under Alternative A. Total dispersed operation and maintenance funding is lowest under Alternative E.

Roads accessing popular dispersed camping areas are maintained at current levels under Alternatives PA, A, B and C. Dispersed road maintenance funding is considerably less

under Alternative E, resulting in deteriorating road conditions. Reduced outputs in Alternative E are a consequence of lower recreation road maintenance standards.

All of the alternatives, except Alternative A, provide adequate funding to maintain hiking trails for user safety and convenience. Funding under Alternative E allows minimum trail maintenance for elimination of safety hazards and prevention of resource degredation.

The capability of the alternatives to provide a quality setting for dispersed recreation is tied directly to the amount of financing and resultant maintenance service level. Maintenance levels for dispersed recreation are described in terms of standard and less than standard management. The proportion of the total Forest area managed under these maintenance levels varies by alternative.

Table 84. Proportion of Total Forest Area Managed at Standard and Less than Standard Service Levels by Alternative

Service Level	Alternatives PA	A	B	C	D	E
Standard Service Level	100%	0	100%	100%	74%	69%
Less Than Standard Service Level	0	100%	0	0	26%	31%

* Standard service level - Management objectives are designed to enhance visitor experience by providing for a natural appearing setting in all dispersed areas.

Less than standard service level - Management objectives are designed to meet minimum health and safety standards rather than enhance the quality of recreation experience.

As shown in Table 84, Alternatives PA, B and C manage the entire Forest at standard service level. Under these alternatives, and to some extent Alternatives D and E, inspection and maintenance of facilities and popular dispersed camping areas is performed on a regular scheduled basis. News releases, interpretive signing and other information services are provided at increased levels. Alternatives A, D and E provide for less than standard management of all or portions of the Forest. Maintenance of popular dispersed camping areas and facilities occurs at minimum levels under these alternatives and user satisfaction may be less. Accumulated evidence of use may detract from the natural setting of popular dispersed areas. Area and facility closures may be necessary to prevent resource damage.

The number and type of dispersed recreation investments proposed under each alternative also influences the degree of issue resolution. Table 85 displays the variety and scheduling of investments considered under each alternative.

Table 85. Dispersed Recreation Investment Schedule by Alternative

Name of Facility **	Planning Period Construction Occurs by Alternative PA	A	B	C	D	E
Dispersed Water Impoundments						
Lockett Lake	PP1	-	-	-	-	PP1
Spring Valley	PP1	-	PP1	PP1	-	PP1
MC Tank	PP1	-	PP1	-	-	PP1
Franks Lake	-	-	-	-	-	-
Russell Tank	PP1	-	PP1	PP1	-	-
Junction Tank	PP1	-	PP1	PP1	-	PP1

Table 85. [cont.] Dispersed Recreation Investment Schedule by Alternative

Name of Facility **	Planning Period Construction Occurs by Alternative					
	PA	A	B	C	D	E
Crystal Spring	–	–	–	–	–	PP1
Big Springs	PP1	–	PP1	–	–	–
Vista Point Improvement						
Crazy Jug Point	–	–	PP2	–	–	–
Timp Point	PP2	–	–	PP2	–	–
Marble View	–	–	–	–	–	PP2
East Rim View	–	–	–	–	–	PP2
Royal Arches	PP2	–	–	–	–	–
Trail Construction						
Northside Rim	PP1	–	PP1	–	–	PP1
Bixler Saddle	PP1	–	–	–	–	–
West Dogtown Extension	–	–	PP2	–	–	–
North Bill Williams Connector	–	–	PP2	–	–	PP2
Jacob Lake Nordic Ski Trail	PP1	–	PP1	PP1	–	PP1
Trailhead Construction						
Bixler Saddle Trailhead	PP1	–	PP1	–	–	–
Benham Trailhead	PP1	–	PP1	–	–	–
Pumpkin Trailhead	–	–	–	PP1	–	PP1
South Kendrick Trailhead	–	–	–	PP1	–	PP1
Bull Basin Trailhead	–	–	–	PP1	–	PP1
Spring Valley Trailhead	–	–	PP1	–	–	PP1
N. Bill Williams Trailhead	–	–	PP1	–	–	–

* PP1 denotes construction in planning period 1, PP2 in planning period 2.

** Dispersed water impoundment projects provide for development of a fishery, construction of sanitary and parking facilities and access road improvement. Trailhead projects provide parking and sanitary facilities and interpretive signing. Scenic vista projects include provisions for access road improvement and the construction of parking, sanitary and interpretive signing. The Jacob Lake nordic ski trail project includes provisions for groomed ski trails, camping facilities, equipment rentals and guide services under concession special use permit.

Table 86. Average Annual Dispersed Investment Costs by Alternative

Average Annual Cost	Alternatives PA	A	B	C	D	E
Planning Period 1	$13,346	0	$11,680	$7,081	0	$11,604
Planning Period 2	$3,485	0	$4,718	$1,076	0	$4,111

Dispersed recreation investments are proposed under Alternatives PA, B, C and E. Dispersed investment opportunities are highest under Alternative PA and lowest under Alternative C. Alternatives PA, B and E provide for similar opportunities in planning period 1. Fewer dispersed investments are scheduled in the second planning period in all of the alternatives.

Alternatives PA, B, C and E all provide for additional hiking trail construction. Trail and trailhead investment opportunities are greatest under Alternatives B and E.

Table 87. Acres Closed to Off-Road Vehicle Use by Alternative*

	Alternatives PA	A	B	C	D	E
Acres Closed	14,522	11,392	14,522	14,522	11,932	14,482
Percent Increase From Current	27%	0%	27%	27%	5%	27%

* Excludes 110,870 acres of wilderness which are also closed to ORV use.

All of the alternatives except Alternative A provide for additional ORV closures to protect resource values and prevent user conflicts. Resource damage in certain sensitive areas is likely to occur from unrestricted vehicle use under Alternatives A and D.

Irreversible and Irretrievable Commitments

Irretrievable commitments related to the dispersed recreation resource include lost opportunities in dispersed recreation output for the first planning period and slight reductions in site productivity attributed to soil loss from ORV damage. Both of these potential impacts are considered insignificant. No irreversible commitments have been identified.

Table 88. Irretrievable Dispersed Recreation Commitments by Alternative for Planning Period 1

Irretrievable Commitment	Alternatives PA	A	B	C	D	E
Average Annual Output (MRVD's)	279.2	254.8	278.7	279.2	255.3	254.3
Difference in Highest Annual Output (MRVD's)	0	24.4	0.5	0	23.9	24.9

WILDERNESS

The Arizona Wilderness Act of 1984 established the Kendrick Mountain, Saddle Mountain and Kanab Creek Wilderness areas on the Forest. Aside from their roadless nature, the three areas possess physical attributes appropriate for wilderness classification. These same features have precluded any management activities with the potential to significantly alter wilderness characteristics. As a result, the three wilderness areas have essentially remained in a natural state. Wilderness management intensities of the planning alternatives address the need to maintain and enhance wilderness characteristics.

Management of the Sycamore Canyon Wilderness, which encompasses portions of three National Forests including the Kaibab, is addressed in the Coconino National Forest Land Management Plan, and managed by the Coconino National Forest.

Alternative A, representing the current situation, reflects management conditions prior to wilderness classification of the three areas. Wilderness management funding and administration levels under Alternative A are not adequate to meet the legal responsibilities and obligations of the Wilderness Act of 1964 and the Arizona Wilderness Act. Alternative A does, however, provide a baseline that is useful for comparison of other planning alternatives. Wilderness management funding for Alternatives PA, B, C, D and E, displayed in Table 89 reflect financing levels that meet or exceed legal responsibilities for wilderness management.

Table 89. Average Annual Wilderness Management Funding by Alternative

	Alternatives					
	PA	A	B	C	D	E
Planning Period 1	$14,608	$875	$14,608	$38,057	$14,608	$14,608
Planning Period 5	$11,486	$875	$11,486	$22,470	$11,486	$11,486

Funding under all alternatives except A is adequate to cover costs for trail maintenance and signing, initial boundary posting and maintenance, periodic wilderness patrols and preparation and publishing of maps and information brochures. Additional funding under Alternative C establishes two wilderness ranger positions to conduct regular patrols throughout the primary use season. Reductions in financing after the first planning period reflect completion of wilderness boundary description and posting.

Table 90. Average Annual Wilderness Use in RVD's by Alternative

Wilderness Area	Potential Capacity	Alternatives PA	A	B	C	D	E
Kendrick Mountain							
Planning Period 1	2,800	1,962	981	1,962	1,962	1,962	1,962
Planning Period 5	2,800	2,290	1,460	2,290	2,290	2,290	2,290
Saddle Mountain							
Planning Period 1	10,700	2,722	1,361	2,722	2,722	2,722	2,722
Planning Period 5	10,700	4,050	2,025	4,050	4,050	4,050	4,050
Kanab Creek							
Planning Period 1	9,900	2,722	1,361	2,722	2,722	2,722	2,722
Planning Period 5	9,900	3,925	2,025	3,925	3,925	3,925	3,925
Total All Wilderness Areas							
Planning Period 1	23,400	7,406	3,703	7,406	7,406	7,406	7,406
Planning Period 5	23,400	10,895	5,510	10,895	10,895	10,895	10,895

With the exception of Alternative A, all wilderness areas are managed at standard service level. Alternatives PA, B, D and E protect and maintain wilderness characteristics by focusing administration efforts in high use areas and along wilderness boundaries. Temporary restrictions may be necessary in concentrated use areas to prevent resource damage under these alternatives. Visitor contacts are infrequent.

Alternative C enhances wilderness characteristics through regular scheduled patrols and visitor contacts in high use areas. Non-conforming uses are eliminated under this alternative. The fire-lookout tower and several low power communication installations on the summit of Kendrick Mountain are dismantled and relocated outside the wilderness area under Alternative C.

No additional trails are constructed within wilderness under any alternatives. Existing wilderness trail systems are adequate to serve projected use through the fifth planning period.

Projected wilderness outputs are identical under all alternatives except Alternative A. With the exception of Kendrick, projected use of all wilderness areas remain below potential capacity through the fifth planning period. Projected use of Kendrick Mountain wilderness approaches potential capacity in the fifth decade. Some form of rationing system may be necessary in the latter planning periods to regulate use of Kendrick.

Use of all wilderness areas is expected to double from outputs reflected under the current management alternative as a result of information services and publications provided in Alternatives PA, B, C, D and E. Potential capacity of wilderness areas may increase somewhat under the intensive management regimes of these alternatives.

All planning alternatives allow for continued livestock grazing as provided by legislation. Maintenance and reconstruction of range improvements occurs only when needed to protect the wilderness resource. Livestock use is within estimated grazing capacity under all alternatives.

Fire management and insect and disease control are the same in all alternatives. The alternatives allow fire to play a more natural role in the wilderness ecosystems, as long as resource values of adjacent areas are not unduly threatened. Insects, disease and fires are monitored in wilderness areas under all alternatives to ensure protection of resources outside the wilderness.

Irreversible and Irretrievable Commitments

Irreversible and irretrievable effects on the wilderness resource and the quality of the wilderness experience may result from long-term management under Alternative A. There are no irreversible or irretrievable commitments resulting from wilderness management in the other planning alternatives.

VISUAL RESOURCES

Resource management activities proposed under the various alternatives have the potential to impact visual resources. Timber harvests and cultural treatments, range, wildlife and soil and watershed projects, and construction or expansion of utility corridors can drastically alter landscape characteristics through the manipulation and clearing of vegetation. The alternatives address visual concerns by applying different levels of visual quality constraints to these resource practices in various sensitive road corridors.

Acres of assigned visual quality objective, displayed in chapter 3, do not vary by alternative. However, the degree of constraints or visual quality standards applied to other resource management activities to meet assigned visual quality objectives varies considerably under the alternatives.

Visual quality standards considered under the alternatives can be described in terms of low, moderate and high. Both the magnitude of visual quality constraints and the specific area of their application vary by level of visual management intensity.

The high visual management intensity level achieves assigned visual quality objectives through intensive management of visually sensitive areas. Condition class distribution objectives under this level provide for predominately mature and overmature age classes in most major road corridors and adjacent to developed recreation sites. Stand sizes are small and harvest entry intervals are extended. Prompt cleanup of activity slash is required for all vegetative treatments. Forage utilization is restricted in several visually sensitive meadows along Arizona highway 67. Expansion of existing overhead utility corridors and construction of new corridors is prohibited within site distance of specified roads.

The moderate visual management intensity level achieves assigned visual quality objectives by establishing standards for the same resource management practices, but to a lesser degree. Visual quality constraints are applied to fewer road corridors and condition class objectives allow more even distribution of age classes. Maximum allowable stand sizes are increased slightly and harvest entry intervals are decreased. Activity slash cleanup, forage utilization and utility corridor requirements are identical to those prescribed under the high visual management intensity level.

The low visual management intensity level achieves visual quality objectives in sensitive areas to a minimum extent and closely resembles the current degree of visual quality constraints. Resource management practices are modified along federal and state highways and age class distribution is allowed to approach a more regulated condition. Maximum stand sizes and harvest entry intervals are relaxed, but still provide for visual diversity. Prompt cleanup of activity slash is required in specified road corridors.

Under all alternatives, areas not identified as visually sensitive are managed to achieve modification visual quality objectives.

Potential impacts to visual resources can be estimated based on the visual management intensity allocation by alternative.

As shown in Table 91, Alternatives PA, B, C, D and E provide for more intensive management to meet visual quality objectives than Alternative A which represents the current management situation. Alternatives PA, B and E manage a substantial portion of the Forest under the high visual management intensity level, and thus offer the greatest degree of visual diversity.

Visual quality objectives are achieved under a similar allocation of visual management intensity levels for Alternatives PA and B. Under these alternatives, landscape diversity is enhanced in numerous sensitive road corridors and adjacent to developed recreation areas through condition class objectives which emphasize mature and overmature age classes and through stand size, harvest entry interval and activity slash cleanup restrictions.

Alternative A attains assigned visual quality objectives in visually sensitive areas in a less intensive manner than the other alternatives. Visual diversity is still maintained in several important road corridors and in high use recreation areas through timber treatment modifications, however a gradual decline in visual diversity may occur in many other sensitive areas.

Table 91. Allocation and Level of Visual Resource Constraints by Alternative

Level of Visual Resource Constraint	Proportion of Total Forest Area Allocated by Alternative					
	PA	A	B	C	D	E
Low Level of Visual Constraints	0	100%	0	0	26%	31%
Moderate Level of Visual Constraints	73%	0	76%	87%	74%	34%
High Level of Visual Constraints	27%	0	24%	13%	0	35%

Irreversible and Irretrievable Commitments

There are no irreversible commitments of resources from visual management practices under any alternatives. Minor irretrievable commitments of timber may occur in Alternatives PA, B, C, D, and E from condition class objectives which feature mature and overmature age classes and extended harvest entry intervals in sensitive road corridors.

CULTURAL RESOURCES

The cultural resource management program on the Kaibab is funded largely by support money from other resource management activities which is used almost exclusively for survey field work in advance of ground disturbing projects. This emphasis on clearance survey has led to the identification of three major issues: 1) the need to conduct survey in areas that are not likely to be subjected to ground disturbing projects; 2) the need for a program of evaluation of sites for National Register eligibility and; 3) the need for an overview document. Each of the planning alternatives affects cultural resource management by the number of acres requiring project related clearance and the level of funding provided for resolution of the cultural resource issues. Consultation with the State Historic Preservation Officer and, when necessary, the Advisory Council on Historic Preservation in conjunction with the identification, protection and management of cultural resource sites occurs under all alternatives.

Table 92 displays the approximate amount of project acres that require cultural resource clearance by alternative. Cultural resource survey is required under all of the alternatives to support various levels and combinations of fuelwood harvest, commercial timber harvest, soil and watershed improvement and wildlife habitat improvement projects. Other management activities that require cultural resource survey include mineral exploration and development, road maintenance and land adjustments. The amount of cultural resource survey to support these activities are not displayed in the following table, however, the additional survey required should be relative to the total survey acres displayed for each alternative.

Table 92 shows that acres requiring cultural resource survey in the first planning period are substantially higher under Alternatives PA and E than in Alternative A. Current level project acres displayed under Alternative A reflect an emphasis on survey requirements almost exclusively in commercial timber areas. Higher acreage figures in the other planning alternatives are largely a result of increased treatments related to soil and watershed and wildlife habitat improvement projects, range retreatments and fuelwood harvests. This has important consequences since these treatments focus on woodland areas which are currently receiving relatively little attention. The shift in project emphasis to woodland treatments under the alternatives partially resolves the issue involving the need for survey in non-project areas. With the exception of Alternative E, each of these alternatives satisfies this issue in proportion to the increase survey acreage above current.

Increased survey acreage under Alternative E reflects elevated levels of commercial timber treatments. Alternative PA provides for the greatest quantity of survey in areas not currently receiving much emphasis. Alternatives B, C, D and E provide less coverage, but still allow for survey of woodland areas above the current level reflected under Alternative A.

Table 92. Average Annual Acres of Treatment Requiring Cultural Resource Survey by Alternative

Treatment Type	Alternatives PA	A	B	C	D	E
Planning Period 1						
Range Retreatments	867	0	1,235	94	1,298	0
Site Prep for Forestation	2,176	2,118	0	319	1,279	2,893
Seeding for Forage Improvement	1,988	0	884	1,236	847	903
Commercial Thinning	6,438	4,776	9,363	7,328	5,531	3,812
Shelterwood Harvest	5,198	7,529	2,835	2,596	4,953	11,489
Fuelwood Harvests	3,588	2,102	4,002	3,058	3,612	2,080
Road Obliteration	31	16	30	65	25	28
PLANNING PERIOD 1 TOTAL	20,306	16,541	18,349	14,696	17,545	21,205
	Planning Period 5					
Range Retreatments	528	348	1,235	331	1,298	110
Site Prep for Forestation	1,980	3,936	1,010	907	4,570	3,129
Seeding for Forage Improvement	1,988	0	884	1,236	847	857
Commercial Thinning	566	2,541	4,080	3,266	2,866	4,954
Shelterwood Harvest	7,379	12,666	14,231	5,574	8,948	8,606
Fuelwood Harvests	3,588	2,102	4,002	3,058	3,612	2,080
Road Obliteration	20	16	23	0	25	9
PLANNING PERIOD 5 TOTAL	16,049	21,609	25,465	14,372	22,166	19,745

Table 92 also indicates that, under most alternatives, acres requiring clearance in planning period 5 are substantially different than planning period 1. This conclusion is not entirely correct since some of the acres to be treated in the latter planning periods will probably have been surveyed for cultural resources in prior periods.

All alternatives except Alternative A and C provide for elevated levels of project treatments involving surface disturbance. The potential for inadvertent cultural resource site damage from project activities is therefore greatest under Alternatives PA and E which provide for the highest levels of project treatments. Acres requiring cultural resource survey under Alternative E are primarily associated with increased timber management activities in the commercial timber areas, as opposed to treatments in the woodland areas. Since site densities in the high elevation coniferous forest are generally lower than the those encountered in the woodland and transition zone areas, the potential for inadvertent site damage is somewhat less under Alternative E. To ensure minimal site damage, all alternatives include provisions for cultural resource site monitoring in proportion to acres of project treatments.

The alternatives also provide for various levels of funding for non-project related activities and resolution of cultural resource issues, as shown in Table 93.

Table 93. Average Annual Financing for Program Administration, Non-Project Survey and Site Evaluation by Alternative

	Alternatives					
	PA	A	B	C	D	E
Planning Period 1	$46,703	$20,070	$46,585	$46,728	$37,822	$39,746
Planning Period 5	$31,846	$20,070	$26,617	$25,641	$19,853	$29,340

With the exception of Alternative A, all of the alternatives contain financing specifically earmarked for preparation of an overview document. These alternatives provide for the completion of a cultural resource overview for both the North Kaibab Ranger District and south side ranger districts in Planning Period 1.

The funding level under Alternative A reflects financing necessary to perform various administrative duties of the cultural resource management program as currently defined, which are not directly linked to support projects or resolution of the cultural resource issues. Alternatives PA, B, C, D and E also provide for this current level of program administration plus additional financing for issue resolution through survey in non-project areas and for cultural resource site evaluation. Additional financing for non-project survey and site evaluation is similar under Alternatives PA, B and C, but somewhat less under Alternatives D and E.

Initial emphasis is directed towards survey of non-project areas under Alternatives PA, B, C, D and E, as opposed to site evaluation. However, site evaluations are accomplished at levels substantially greater than current under all of these alternatives. Under all alternatives, areas suitable for commercial timber production are expected to eventually receive cultural resource survey in connection with timber management activities. As such, the woodland area and transition zone between the woodland and commercial timber types are targeted for the majority of non-project related survey. As information is gained about the distribution and relative significance of sites through project and non-project related survey, program emphasis shifts to site evaluation in the latter planning periods under Alternatives PA, B, C, D and E.

All of the alternatives except Alternative A provide for the protection and management of the Beale Wagon Road on National Forest System lands as a National Historic Trail. Short- and long-term impacts to the trail are the same under these alternatives except for those portions of the trail on non-federal lands. Increased development pressures on private lands may gradually degrade the historic route through these areas. However, significant historic sites and junction points on non-federal lands are protected through cooperative efforts with other land owners under the alternatives.

The relative remoteness of the Forest from major population centers and the ephemeral character of most cultural resource sites contribute to the currently low incidence of cultural resource site vandalism. Cultural resource site vandalism is not expected to increase under any alternative. Knowledge of site distribution and relative significance gained under Alternatives PA, B, C, D and E may enable more effective monitoring and enforcement and result in decreased site vandalism.

Irreversible and Irretrievable Commitments

Irreversible and irretrievable commitments to cultural resource sites occurs when inadvertent site damage and vandalism disturbs sites to a degree which precludes information retrieval. Increased monitoring efforts under Alternatives PA, B, C, D and E minimize irreversible and irretrievable commitments to cultural resources.

WILDLIFE AND FISH

Wildlife Habitat

The Forest provides habitat for about 392 species of wildlife, including sixteen selected management indicator species. The indicator species represent a cross section of wildlife species selected because their population changes are believed to indicate effects of management activities on other species of a major biological community or on water. The extent of other resource uses, habitat improvements and

the extent of wildlife coordination impacts habitat. The effects on both quality and quantity of wildlife habitat vary by alternative.

Those activities having the greatest impacts on wildlife are timber and range management. Timber and fuelwood harvest are the primary factors which affect the quality and quantity of forest plant succession and its associated value as habitat. Timber harvest can open stands and create foraging area which benefit early seral stage species such as elk and mule deer. If the forage areas are too large and poorly planned, other species which require dense habitat or large mature or overmature trees will suffer. By managing for small stands and between stand diversity, the integration of stand management with habitat needs can be made.

Although the amount of younger age class trees decreases, effective cover increases as a result of improved coordination and integration of resource activities. As a result of the current imbalance of age classes, particularly on the south side of the Kaibab, the modeled effect of cover exaggerates the population capability for currently existing habitat. Existing populations of game species are lower than the modeled habitat capability as the forage and cover values are averaged. As the Forest approaches regulation, the relative amount of younger age classes decreases and the amount of total hiding cover decreases. With the exception of Alternative A, standards and guidelines of all alternatives provide adequate amounts of cover to maintain current levels of big game populations. Alternative A shows a declining trend in habitat for the majority of game and non-game species.

Table 94. Habitat Improvement Acres by Alternative for First Planning Period

Treatment Type	PA	Alternatives A	B	C	D	E
Suitable						
Burning	34850	0	28380	39680	27200	29000
Plant/Seed	19738	0	8450	11810	8100	8630
Unsuitable						
Brush Treatment	1900	0	1470	2060	1420	1500
Burning	13290	0	3930	5490	3770	4010
Plant/Seed	9830	0	4910	6860	4710	5020
Special Cutting (Aspen)	760	0	390	540	370	400
Pinyon and Juniper						
Browse Improvement	25230	0	12820	17920	12280	13130
Burning	22190	0	16200	22650	15530	16580
Plant/Seed	35510	0	15710	21970	15060	16050
Seral Grassland						
Not Suitable	4820	0	4420	6180	4230	4500
Total Acres Treated	168136	0	96680	135160	92570	98800

Old-growth acres in all alternatives maintain viable populations of old-growth dependent wildlife species. Alternative PA provides for a substantial increase in old-growth characteristic habitat over current levels and results in a better old-growth distribution across the Forest.

Diversity and Wildlife Habitat Improvement

Diversity in habitats and animals is almost exclusively dependent on the level of wildlife planning, habitat improvement and coordination with other resource activities.

The diversity index value defines the relative mix of acres on the Forest. It quantifies the diversity between different stands within each vegetative type, and the diversity between different vegetative types. The minimum diversity index value of "0" indicates no diversity (e.g. the entire Forest in one vegetative type). The maximum diversity index value of "1" indicates an optimum mix of habitats for wildlife (e.g. all age classes of all potential vegetative types are represented in optimum distribution across the Forest). The procedure for computing diversity index values

is documented in the planning record. Diversity index values for the alternatives are displayed in Table 95.

As shown in Table 95, Alternatives PA and C have the highest level of diversity or interspersion of habitats. Alternatives B and D show a moderate increase in absolute diversity of habitats. Alternatives A and E reflect a decline in interspersion of habitats.

A change in vegetation composition or a change in vegetative volume or structure will affect the quantity of diverse habitats and animal taxa which utilize those habitats. A managed forest which offers a high degree of diversity in communities and seral stages not only ensures ecological stability but provides habitat for diverse wildlife.

Table 95. Diversity Index Values for Planning Periods 1 & 5 by Alternative

	Alternatives					
Planning Period	PA	A	B	C	D	E
Planning Period 1	.50	.44	.50	.54	.49	.45
Planning Period 5	.49	.42	.45	.53	.51	.40

Table 96. Change in Diversity Index Values for Planning Periods 1 & 5 by Alternative

	Percent Change by Alternative					
Planning Period	PA	A	B	C	D	E
Planning Period 1	13.6%	0	13.6%	22.7%	11.3%	2.3%
Planning Period 5	11.4%	-4.5%	2.3%	20.4%	16%	-9.0%

Activities specific to the improvement of wildlife habitat on the Forest include vegetative manipulation through the use of timber harvesting, direct treatment using fire or mechanical means, seeding and planting of desirable browse and herbaceous species, and access or road management. Minor programs in non-game and waterfowl habitat improvement are also carried out on the Forest and include but are not limited to constructing waterfowl nest structures, installing bird boxes, planting waterfowl foods, protection and creation of snags, and seeding and planting wildlife forage species. Prescribed fire, timber harvesting and livestock grazing are the main activities affecting wildlife. Prescribed burning occurs on lands suitable and unsuitable for timber production.

Wildlife appropriations provide for wildlife coordination with other resource uses and generate a large amount of direct habitat improvements. Wildlife coordination with other resource uses affects quality of habitats and has a direct bearing on future habitat capability. Additional improvements identified through coordination result from Knutsen-Vandenburg (K-V) Act collections from the sale of timber and fuelwood.

Effects of each alternative on quality of wildlife habitat are summarized in Table 97. This table displays the relative difference in levels of habitat coordination, planning, and improvement. The percent change under each alternative is a comparison of fifth decade levels to existing levels.

Table 97. Changes in Habitat Quality From Habitat Improvements by Alternative

	Percent Change by Alternative					
	PA	A	B	C	D	E
Planning Period 5	287%	-1%	146%	204%	140%	141%

Alternatives PA and C provide for levels of direct and indirect habitat improvements that result in significant increases in habitat capability by the end of the fifth decade. Alternatives B, D and E provide for moderate increases in habitat capability over the five decade period. These alternatives increase habitat diversity and maintain or enhance wildlife populations.

Levels of improvement in Alternative A are reduced, resulting in long-term declining trends in habitat capability. Under Alternative A, coordination with other activities is limited and habitat diversity declines.

Indicator Species

The management indicator species were selected because their population changes are believed to indicate effects of management activities on other species of a major biological community or on water quality.

Alternative resource management levels change habitat conditions, and this change is indicated by change in the management indicator species. Relative impacts on indicator species habitat are displayed in Table 98. The ratings are based on how well each alternative is able to meet the species forage and cover requirements. Road density is an additional habitat quality factor which affects the management indicator species of elk and Merriam's turkey. Management indicator species and their suitable habitats are managed above the requirement to maintain minimum viable populations in all alternatives.

Table 98. Changes in Habitat Capability for Indicator Species in Planning Period 5 by Alternative

Indicator Species	Percent Change by Alternative					
	PA	A	B	C	D	E
Goshawk	49%	23%	41%	74%	26%	-3%
Pygmy nuthatch	99%	55%	89%	140%	92%	46%
Turkey	2%	-5%	1%	6%	3%	-7%
Red squirrel	43%	21%	29%	93%	43%	7%
Spotted owl	158%	82%	123%	288%	150%	27%
Elk	-4%	-7%	-7%	-3%	-3%	0
Abert's Squirrel	10%	5%	5%	28%	10%	0
Hairy woodpecker	240%	155%	252%	310%	234%	161%
Yellow bellied sapsucker	41%	27%	44%	50%	36%	37%
Plain titmouse	2%	0	0	-3%	0	68%
Mule deer	5%	-3%	4%	-5%	2%	-9%
Antelope	7%	-10%	7%	26%	4%	2%

*Based on acres that produce forage and cover components.

Alternative PA provides the best distribution of diverse habitats for the greatest number of species due to habitat capability and elevated levels of direct and coordinated habitat improvement. Alternative C supplies a balance of habitats and provides the largest increase in late seral stage pine/mixed conifer habitat. Alternatives PA and C offer the greatest habitat capability increases for big game due to increased levels of habitat improvement and coordination with other resource

activities. A majority of habitat improvement acres are identified in big game wintering areas.

In Alternatives B and D, habitat capability increases at moderate levels. Elk habitat reflects a net decrease while mule deer and turkey habitat show a slight increase. Although Alternative PA shows a relatively static big game habitat capability, increases in potential population capacity are expected. Old-growth and snag dependent species show a marked increase by the fifth decade over the existing situation. Alternatives PA and C not only provide for elevated levels of habitat improvement, but also increased levels of coordination result in upward trends in habitat capability for most species.

Decreases in habitat capability in Alternatives A and E are not offset by coordination activities or habitat improvement. Overall habitat diversity and quality therefore decreases. Old-growth dependent species decline and foraging areas for early succession species also decrease.

Vegetation Structure and Successional Stages

Vertical vegetation structure generally favors late seral stage species and characteristically provides thermal cover. Horizontal vegetation structure generally provides habitat for early seral stage species and provides hiding and escape cover. Table 99 shows the relative amounts of vertical and horizontal cover present by alternative.

Table 99. Changes in Existing Wildlife Cover in Planning Period 5 by Alternative

	Percent Change by Alternative					
	PA	A	B	C	D	E
Cover	23%	-12%	13.5%	46%	18%	2.5%

Alternatives PA and C strongly favor cover requirements for elk, mule deer and turkey, while promoting cover needs for mid and late seral species.

Alternatives A, B and D are moderate in providing a cover habitat component. Alternative E provides a low to inadequate level of cover habitat for most species.

Special Habitats

Snags. Quality snag habitat is essential for maintaining viable populations of primary and secondary cavity users and is deficient on the Forest. Those avian species utilizing or depending on snag habitats promote the health of the forest ecosystem. Habitat capability for primary and secondary cavity users is correlated with the level of structural improvements, old-growth acres and total snag qualified acres.

Table 100. Change in Habitat Capability for Primary and Secondary Cavity Nesters in Planning Period 5 by Alternative

	Percent Change by Alternative					
Cavity Nester	PA	A	B	C	D	E
Hairy woodpecker	241%	155%	252%	310%	234%	161%
Yellow bellied sapsucker	41%	27%	44%	50%	36%	37%
Pygmy nuthatch	99%	55%	89%	140%	92%	46%
Plain titmouse	2%	0	0	-3%	0	68%

Alternatives PA and C benefit cavity nesters most as a result of more intense management through coordination, direct habitat improvements and higher levels of old-growth characteristic areas which have a snag component.

Alternatives B and D provide increases in snag habitat over existing levels. Alternatives A and E provide the lowest increases in snag habitat.

Old-growth. Old-growth habitats in forested ecosystems are vital elements of forest diversity and productivity. Spatial distribution and between stand diversity are promoted in old-growth prescriptions to induce age complexity of a managed forest.

As shown in Table 101, all alternatives show an increase in old-growth characteristic habitat. Alternatives PA and C reflect the greatest increase with Alternatives B and D showing a moderate increase. Alternatives A and E have the smallest increase.

Short-term effects related to foregone timber volumes are greatest for stands currently meeting or close to meeting old-growth characteristics where harvests are deferred. In the long-term, extended rotations provide a balance of age classes and habitats. Old-growth dependent wildlife species should eventually experience improved distribution and abundance under all alternatives.

Table 101. Changes in Old-growth Habitat in Planning Period 5 by Alternative

	Percent Change by Alternative					
	PA	A	B	C	D	E
Percent Change	108%	86%	55%	224%	94%	5%

Comprehensive Plan

Management requirements relating to Arizona's Wildlife and Fisheries Comprehensive Plan require varying levels of habitat management objectives of the State Wildlife Plan. Table 102 displays the success of each alternative in meeting Comprehensive Plan objectives.

Table 102. Attainment of Arizona's Comprehensive Plan Objectives

Alternative	Rating
PA	High
A	Moderate
B	Moderate
C	High
D	Low
E	Low

Threatened and Endangered Species

Under all alternatives, conserving federally listed threatened and endangered species and their habitats receives special management consideration. Sensitive species and State listed species not included on federal lists receive management emphasis to at least maintain habitat necessary to support minimum viable populations and to prevent their placement on federal lists. Management activities are in accordance with approved recovery plans and Arizona's Wildlife and Fisheries Comprehensive Plan.

The wintering bald eagle, the peregrine falcon and the Apache trout are the only known federally listed threatened or endangered wildlife species on the Forest. State listed threatened or endangered species are on the Regional Forester's sensitive species list and are displayed in Table 53.

Habitat management in Alternatives PA, C and B restricts public use around peregrine falcon nest sites during the breeding season and provides for construction of instream structures for Apache trout habitat maintenance. Alternatives PA, C and B also provide for identifying and protecting bald eagle winter roosts.

Resource activities involving vegetation disturbance require on-the-ground investigation for sensitive, candidate and T&E species to assure their protection.

All alternatives afford protection for T&E, sensitive and candidate species, and attempt to meet recovery plan objectives.

There are no significant short-term uses that affect long-term productivity of T&E species, no irreversible or irretrievable commitments of the resource and no unavoidable adverse effects. These findings are documented in the biological assessment available for review in the planning record. The biological assessment is incorporated by reference for purposes of analysis in the EIS and Forest Plan.

Wildlife Recreation & Demand

Accelerated efforts in habitat improvement and improved coordination with other other resources and wildlife management agencies have the potential to increase the annual supply of wildlife and fish user days (WFUD's) to 250,000 by the year 2030.

Wildlife habitats are improved under the alternatives, but are not improved fast enough to keep up with projected demand. The consumptive recreation demand for deer and elk continues to exceed supply under all alternatives. Non-consumptive uses of wildlife increase at a faster rate as consumptive uses become more limited. As demand increases, additional stress may be placed on animals through poaching and disturbance. This would be partially offset by road closures and improved road management.

Alternatives PA, C and E show a slight increase in WFUD's, and Alternatives A and B reflect a decrease. Alternative D has only a very slight increase in WFUD's.

The quantitative effect of each alternative on the supply of wildlife recreation is summarized in Table 103. Percent change is presented as a comparison of fifth decade potential to existing levels of WFUD's.

Table 103. Impact of Alternatives on the Existing Supply of Wildlife Recreation

	Percent Change by Alternative					
	PA	A	B	C	D	E
Planning Period 5	2.0%	-2.0%	5.0%	3.5%	0	2.6%

Roads

Optimal usefulness of habitat is important for wildlife to effectively benefit from improved habitat. Roads effect wildlife in several ways but use of roads by human beings has the greatest impact. The effect is markedly influenced by the type of road, its location and degree of use.

Table 104. Increased Habitat Availability Based on Miles of Road Obliteration by Alternative

Alternative	Rating
PA	Moderate
A	Low
B	Moderate
C	Low
D	Moderate
E	Low

Alternatives A, C and E close and obliterate a small amount of roads. Alternatives PA, B and D obliterate and close a moderate amount of roads.

Habitat effectiveness is based on not only quality but availability to the animals. Several vertebrate species are adversely affected by human disturbance and thus avoid roads.

Riparian and Aquatic Habitat

Riparian communities found in defined areas surrounding springs, streams, lakes and dirt tanks provide high-quality recreation areas, productive wildlife habitat and water quality protection. Currently, many problems (notably overgrazing) exist in these areas. The plant communities are characterized by a lack of age class distribution and species composition diversity. The implementation of grazing management systems is expected to promote the enhancement of riparian areas, but these areas must be protected in other ways if they are to be maintained and improved.

Fish are stocked in reservoirs by the Arizona Game and Fish Department to provide a useable recreation resource. Apache trout exist as a self-sustaining population in North Canyon. Any further reservoir construction (such as Adams Dam) will directly increase the availability of these resources.

Concentrated livestock use in riparian areas decreases riparian stand structure, composition and bank stability. Levels of livestock use, timber harvest or burning in upper watersheds can also impact runoff potentials.

Habitat improvement projects such as protection fencing, planting, seeding, stream improvement and watershed stabilizing activities increase stand structure, composition and bank and channel stability of riparian areas.

Levels of habitat and watershed coordination with timber harvest, allotment management, developed recreation sites and road location have a direct impact on riparian condition and potential improvement in riparian areas.

Activities included in alternatives to maintain or improve fish habitat include instream structural improvements, fencing and improvements to stabilize banks, deepen lakes and provide cover. The levels of coordination vary with other resource activities such as range management, timber harvest, recreation and road management.

Alternatives PA and C improve the greatest amount of fish habitat. Alternatives A, B, and D improve a moderate amount of fish habitat. Coordination and improvements serve to mitigate long-term and short-term effects of other land uses in all alternatives except E. Alternative E results in a long-term downward trend in fish habitat.

Threatened and endangered habitats are not reduced below existing status under any alternatives, and populations of all species remain above "minimum viable levels."

Irreversible and Irretrievable Commitments

Losses in wildlife recreation opportunity and ecological diversity are irretrievable under alternatives that reduce habitat carrying capacity. A comparison of wildlife recreation opportunity that is irretrievably lost by the end of the first decade is presented in Table 105. (Comparison is made with the MWFUD's available under the highest output alternative.)

Table 105. Irretrievable Loss of Wildlife Recreation Opportunity in MWFUD's

	Alternatives					
	PA	A	B	C	D	E
	Average Annual Output					
Planning Period 1	181	175	174	190	175	180
Irretrievable Loss	9	15	16	0	15	10

Alternatives A, B and D result in the greatest loss of wildlife recreation opportunities with PA, C and E showing the least.

LANDS

The Forest lands program is a compilation of many real estate activities. These include land acquisition by exchange, donation and purchase, rights-of-way acquisition, sales under the Exchange with Public Schools Act and Townsite Act, processing of Small Tracts Act exchanges, interchanges and sales, land status maintenance, issuance of special use permits, land use agreements, land

classifications, special designations, withdrawal review, title claims and land line location work.

Issues and concerns deal with administrative problems associated with land needs for the expansion of local communities, access to both federal and private lands and the efficient management of special land use permits.

Projected lands management program funding levels for the various alternatives are displayed in Table 106.

Table 106. Average Annual Lands Program Budget for Planning Period 1 by Alternative

Annual Budget	PA	A	B	C	D	E
Planning Period 1	$91,889	$86,696	$92,207	$89,281	$93,790	$82,544

Alternatives PA, B, C and D provide for small increases in program funding above the current level reflected under Alternative A. Budget allocations for these alternatives allow for an overall efficient lands management program. Funding under Alternative E results in substantially reduced land exchange, rights-of-way acquisition and other land adjustment programs. Under Alternative E, all lands related program activities are not as responsive to public and administrative needs, and eventually result in reduced revenues from land use occupancy fees.

Specific consequences to important lands related management activities can be estimated based on funding levels for each alternative.

Land Exchange and Acquisition

Land exchange management issues and concerns address the need for additional privately owned lands adjacent to the communities of Williams, Tusayan and Parks without significantly affecting existing land values or economic structures of other communities. National Forest System lands available for private acquisition through exchange currently total 4,875 acres, and are shown on the Land Adjustment Map. Alternatives PA, B, C, D and E increase the amount of National Forest System lands available for exchange to 9,119 acres. The majority of this increase is adjacent to Williams, Tusayan and Parks.

The lands identified as base-in-exchange and evaluation criteria for land exchange are listed in Chapter 3. The criteria for LWCF purchase and the lands designated for acquisition under LWCF authorities are also listed in chapter 3.

Program funding under Alternatives PA, A, B, C and D allow timely response to most land exchange proposals. The reduced budget level under Alternative E precludes undertaking exchange proposals of a complicated nature involving a substantial amount of data gathering and analysis.

The most significant increase in the supply of base for exchange lands occurs in the vicinity of Tusayan. Unrestricted commercial development of these lands has several implications. Businesses in Williams largely dependent on Grand Canyon visitation may incur substantial losses of revenue. Grand Canyon National Park may experience increased visitation and the community of Tusayan may require additional county services which are currently inadequate.

Impacts of land adjustments in the Tusayan area are partially mitigated under the alternatives by limiting most exchange proposals to local residential needs. Detailed development plans must accompany all exchange proposals and plans are subject to County review and approval.

Base lands in the Parks and Williams areas are available under the existing land ownership adjustment plan. To date, relatively few land exchange proposals have been received for these areas. The increased supply of land available for exchange in these areas under Alternatives PA, B, C, D and E is not expected to significantly affect existing land values, given the acquisition of a similar acreage of private lands by the Forest Service.

No lands are identified as available for acquisition through exchange on the North Kaibab Ranger District in any alternatives.

Land acquisition through exchange procedures is expected to continue at the current rate of approximately 350 acres per year under all alternatives. Continued acquisition of isolated tracts at this rate ultimately benefits Forest management through 1) lower administrative costs from reduced land line location and corner maintenance requirements, and 2) increased resource outputs from the acquisition of lands valuable for wildlife habitat, recreation use and timber production.

Special Uses

Issues and concerns related to the occupancy and use of the National Forest by permit include the timely evaluation of special use applications, efficient administration of permits to protect Forest resources, method and interval of special use fee adjustments and the capability to meet needs for additional electronic sites and utility corridors. Resolution of these issues varies by the degree of responsiveness to special land use proposals and the frequency of special use inspections under each alternative.

Alternatives PA, B, C and D provide a level of administration that enables adequate response to public and administration needs. The primary difference between these alternatives involves the frequency and method of fee adjustments.

Alternatives A and E only allow infrequent field inspection of permits which may eventually lead to long-term management problems. Fees are based on minimum established rates and the capability to respond to permit applications is substantially reduced.

The total amount of National Forest System lands under special use permit at any given time is not expected to vary significantly by alternative. However, the total number of permits and acreages involved are expected to increase gradually over time. Impacts to Forest management from increased acreages under permit are effectively reduced through the intensive review and mitigation processes followed for all special land use applications.

The most significant effects of Alternatives PA, B, C and D are evident in the overall cost efficiency of the respective land use program in each alternative in terms of projected special land use fees. Projected receipts from non-recreation special land use fees are displayed in Table 107.

Table 107. Average Annual* Special Land Use Receipts for Planning Period 1 by Alternative

	Alternatives					
	PA	A	B	C	D	E
Projected Receipts	$69,500	$47,500	$69,500	$69,500	$69,500	$47,500

* Excludes receipts from recreation special land uses.

Lands management funding levels under Alternatives PA, B, C and D enable more frequent and detailed special land use fee determinations which result in substantial projected increases in land use receipts.

Rights-of-Way

Management issues and concerns address the need for public access across both National Forest System lands and private lands in the most efficient manner to facilitate Forest resource management, transportation needs, orderly growth of rural subdivisions and county road maintenance requirements.

Forest Service right-of-way acquisitions across private lands continues at the current level of three to four acquisitions per year under Alternatives PA, A, B, C and D. Under these alternatives, thirty to forty rights-of-way are acquired during the first planning period which essentially eliminates the need for an active right-of-way acquisition program in subsequent planning periods.

Needed right-of-way acquisitions across private lands are greatly reduced under Alternative E. Curtailment of right-of-way acquisitions may reduce Forest resource outputs and public uses by limiting access to portions of the National Forest.

Issuance of road easements to public road agencies continues under all alternatives. The capability for timely review and processing of easement applications is reduced under Alternative E.

Land Line Location

The Forest land line location program is largely tied to support of other resource management activities in each alternative. The alternatives provide for completion of land line survey needs by the end of the first planning period. Approximately 45 miles of property boundary is maintained under the alternatives after completion of the land line location program.

Utility Corridors

Existing major utility corridors can accomodate projected future needs. All of the alternatives allow corridor expansion parallel to existing major powerlines and pipelines. If the need arises for the designation of a new corridor, the selected location will attempt to avoid 1) areas with pristine, primitive and semi-primitive ROS classifications, 2) areas with high cultural resource values, 3) important wildlife habitat areas, 4) areas with special land designations such as research natural areas, 5) visually sensitive areas, 6) ORV closure areas, and 7) land classified as suitable for commercial timber production.

Irreversible and Irretrievable Commitments

No irreversible commitments of resources have been identified from lands related activities under the alternatives. Minor irretrievable commitments of various Forest resource outputs may occur under Alternative E from reduced right-of-way acquisitions.

NATURAL AREAS

The 300 acre proposed Garland Prairie Research Natural Area (RNA) is the only proposed RNA considered in the planning alternatives. During the first planning period, other opportunities for RNA's may be considered. Evaluation of RNA opportunities will be coordinated with other agencies.

Irreversible and Irretrievable Commitments

There are no adverse or irreversible environmental effects from designation of the proposed Garland Prairie RNA. Irretrievable commitments result from resource outputs reduced or lost as a result of special area designation, including the withdrawal of the area to locatable mineral entry. These commitments are considered insignificant given the geologic environment of the area, and the area's small size.

RANGE

A total of 1,268,714 acres of the Forest are classified as full and potential capacity for livestock grazing. Of this total, 790,707 acres are classified as full capacity and 478,007 acres are classified as potential capacity. Areas are classified potential capacity because of accelerated erosion, dense tree overstory, very little forage, lack of access, water developments or other range improvements. Approximately 264,183 acres are classified as no capacity for livestock grazing because of steep slopes, rock outcrops and erodible soils.

Capacity and Permitted Use

The current estimated grazing capacity on the Forest is 71,000 animal unit months (AUM's) annually. Permitted use in 1985 was 88,990 AUM's with 62,760 AUM's actually grazed. Approximately 7,500 AUM's grazed annually are by sheep and 1,080 AUM's by bison. The remainder of the AUM's are grazed by cattle and horses. The maximum potential grazing capacity determined from the Maximum Range benchmark is approximately 121,153 AUM's annually by the fifth decade.

The objective of all alternatives is to maintain permitted use of the forage resource in balance with capacity for the planning period and to improve range condition to moderately high, where possible. All alternatives attempt to maintain a viable livestock industry while protecting the long-term productivity of the range resource. In all alternatives, the permittee is expected to participate with the Forest Service in maintaining structural improvements in working order and to supply labor to rebuild structures that need replacing.

Permitted use is balanced with capacity by the end of the first decade in Alternatives PA, A, B, and D and during the second decade in Alternatives C and E. Thereafter, permitted use is continually adjusted to capacity through management planning, production and utilization surveys, and range analysis for each allotment. Permitted

use and capacities are maintained in balance for the allotments by increasing or decreasing numbers of livestock, by changing the management intensity levels, and by initiating changes in livestock class, season of use, and rotation patterns. Table 108 shows current grazing capacity and that of the first and fifth decades for each alternative. All of the alternatives and the maximum range level benchmark include AUM's from transitory range produced through timber and fuelwood harvests. Departure in each alternative from maximum capacity AUM's is displayed for the first and fifth decades with 121,153 AUM's being 100 percent of the possible capacity (maximum range benchmark analysis in the fifth decade). Alternatives PA, A, B and D show increases in AUM's. Alternative B produces the greatest AUM level at 99 percent of maximum, Alternative A produces 95 percent and Alternative D produces 96 percent of maximum in the first decade.

Management Intensity

The changes in AUM's shown in Table 108 imply changes in management intensity. However, the intensity of management is not always directly associated with AUM numbers. The level of funding, the physical and biological conditions of improvements, and the present level of management have effects on the intensity of management. The environmental consequences of alternatives are reflected in the intensity of management of individual allotments and rangelands. Table 109 shows how management intensity varies by alternative for full capacity acres only.

Table 108. Range capacity by Alternative (MAUM's)

	Alternatives and Maximum Range Benchmark						
Time	PA	A	B	C	D	E	Maximum Range
Present*	710	710	710	710	710	710	710
First Decade	700	713	740	628	715	693	747
Fifth Decade	750	772	1,120	671	943	700	1,120
Relation to First Decade of Maximum Range Benchmark	94	95	99	84	96	93	100

*Present represents year one

Table 109. Full Capacity Range By Management Prescription (Planning Period 1)

Management Intensity Level*	Alternatives					
	PA	A	B	C	D	E
A	(0.3)	(0.3)	(0.3)	(42.6)	(40.6)	(0.3)
B	419.5	142.2	3.3	182.3	0.0	601.1
C	66.7	409.8	79.4	273.8	4.2	133.4
D	308.2	241.6	5.4	316.4	187.9	51.5
E	0.0	0.0	709.4	0.0	585.1	5.4
Total Full Capacity Acres	794.4	793.6	797.5	752.5	757.2	791.4

*Management Intensity Level: A =(no grazing or no full capacity acres); B =low range investment; C = extensive range management; D =intensive range management; E = maximum range management;

The number of acres in each range management intensity level is shown for the fifth decade with "Present" representing the first year of the planning horizon. The consequence of any single alternative is represented by its departure from the present situation. Alternatives B and D show a positive change in management intensity levels. A negative change representing a decrease in intensity of management occurs in Alternatives C and E compared to Alternative A. The PA is only a slight increase in management intensity.

An increase in the number of acres in the upper two management intensity levels (D and E) is interpreted as a positive change in range condition, distribution of livestock, and the frequency of range inspections. Acres under D level management are under a form of rest rotation grazing management plan that is current and being followed by the permittee. Acres at the E level are under a very high intensity system of grazing management, in order to maximize livestock production, with a current management plan that is followed by the permittee.

Capital Investments

Investments for improving or maintaining range conditions are made in both structural and non-structural improvements. The most important improvements to livestock management are structural, with non-structural improvements ranking second. The following order defines the priority of how monies are used: reconstruct existing structural improvements; retreat or revegetate existing non-structural improvements; construct new structural improvements; and undertake new non-structural improvements.

Reconstruction is expected to take place on most structural and some non-structural improvements for Alternatives PA, A, B, and D. The majority of structural improvements are replaced once their serviceable life span has been reached. Range condition with these alternatives improves slightly with the reconstruction of the most important range improvements. Management intensity increases or remains static and reflects more time physically managing livestock rather than depending solely on structures. Alternatives C and E show the greatest potential for the loss of improvements. There is a decrease in the total number of structures that can be replaced once they deteriorate. For Alternatives C and E , range conditions improve slightly because of the balance between permitted use and capacity, however, the intensity of management is downward due to the loss of structures.

The loss of structures due to inadequate funding for periodic replacement of structural improvement contributes to the irretrievable loss of grazing capacity. This results from the loss of management opportunities originally gained through the placement of structures. Table 110 shows the percentage of structures replaced once the end of their serviceable life span has been reached. In the fifth decade, all alternatives replace at least 86 percent of the structural improvements that existed at the start of the planning period. Under Alternatives PA, A, B, and D, basically all structures are in place at the end of the fifth decade.

Table 110. Replacement of Structural Improvements (Percentage)

Decades	Alternatives					
	PA	A	B	C	D	E
1	90*	91	100	83	100	86
2	100	99	100	89	100	93
5	100	99	100	89	100	86

*Of the 4,118 existing structures only 824 need to be replaced per decade.

Table 111. Pinyon-Juniper Vegetative Type Maintained as Grassland

ALTERNATIVES					
PA	A	B	C	D	E
		Acres			
23,424	10,425	37,059	7561	38,952	3288
		Percent			
32	14	51	10	54	5

Maintaining previously treated pinyon-juniper lands considered suitable for retreatment as seral grasslands and savanna woodland for management purposes is an irretrievable loss of fuelwood production. An offsetting effect is sustaining the grazing capacity created by maintaining an earlier successional stage. The amount of

acres maintained as seral grassland varies by alternative. Pinyon-juniper lands not retreated will slowly regrow and increase in crown canopy and density. Grazing capacity will decline but these lands will eventually be useable for firewoood harvest.

Irreversible and Irretrievable Commitments

The difference between the highest AUM capacity alternative and all other alternatives for the first decade represents an irretrievable loss of AUM utilization. Table 112 displays the irretrievable loss of capacity by alternative after comparing the highest output with alternative outputs for the range resource. Alternative B is used as the standard against which all alternatives are measured.

Table 112. Irretrievable Loss of Range Capacity in First Decade (M AUM's)

Output	Alternatives					
	PA	A	B	C	D	E
Highest Output	-	-	74	-	-	-
Output of Alternatives	70	71	74	63	71	69
Irretrievable Loss	4	3	0	11	3	5

TIMBER

The alternatives affect the timber resource by the intensities of silviculture applied and the acreage managed for timber production. The effects are characterized by differences in the acres of suitable timber lands, age class distribution, growth and long-term sustained yield, acres of regeneration harvest, allowable sale quantities, health and vigor of the stands, acres allocated to extended rotations, and levels of fuelwood harvest.

The alternatives are compared within the scope of the commercial timber and fuelwood issues for the Forest. The comparison of the environmental consequences associated with each alternative responds to the direct and indirect effects and their significance.

Suitability

Using the criteria for determining tentatively suitable timber acres (36 CFR 219.14), 492,436 acres are classified as tentatively suitable for timber production. See the timber section of the AMS document for a discussion of suitability determination. The alternatives use different proportions of the tentatively suitable acreage to achieve the outputs, goals, and objectives unique to each alternative. Table 113 displays the suitable acres allocated to timber harvest for each alternative.

Table 113. Suitable Acres Allocated to Timber Harvest by Alternative

Alternative	PA	A	B	C	D	E
Acres	439,944	492,436	461,209	362,612	4301975	487,960
Percent of Tentatively Suitable	90	100	94	74	88	99

Alternatives A and E allocate 100 percent and 99 percent of the tentatively suitable acres to timber harvest. Alternative A, current management, demonstrates that all of the tentatively suitable acres are being considered for timber harvest. Alternative E maximizes present net value by allocating 99 percent of the tentatively suitable acres to timber management, and harvesting the most total commercial volume from those acres.

Alternatives PA, B, and D allocate between 88 percent and 94 percent of the tentatively suitable acres to timber management. These alternatives harvest less

commercial volume than Alternative E, as they attempt to better resolve other resource issues and concerns, primarily wildlife and range.

Alternative C emphasizes non-commodity goals and objectives and allocates the fewest acres to timber harvest, 74 percent of the tentatively suitable land.

There are no irreversible commitments of resources made resulting from suitability. There are irretrievable commitments made from the loss of commercial forest products during the first decade from those lands classified as not suitable for timber harvest.

Unsuitable lands and lands not appropriate for timber harvest are reexamined during the first decade to determine whether reclassification is necessary.

Growth Rate and LTSYC

The President's Revised Statement of Policy, PL 96-514 (December 12, 1980), requires that the productivity of suitable forested land be maintained or enhanced to minimize inflationary impacts of wood product prices and to permit a net export of forest products by 2030.

The "Statement" recognizes that these goals are long-term. It requires that by decade 5, growth on commercial timber lands be brought to and maintained, where possible, at 90 percent of the long-term sustained-yield capacity (LTSYC).

LTSYC of wood fiber output is equivalent to average growth over time. Growth in decade 5 and LTSYC are compared in Table 114. Harvest levels or commercial outputs at the LTSYC are not realized if growth rates are not near potential by decade 5.

Table 114. Annual LTSYC Compared to Achievement of 90 Percent of Potential Growth in the Fifth Decade by Alternative

Outputs	Alternative					
	PA	A	B	C	D	E
Growth (MCF)	15,053	15,701	10,813	12,084	13,077	18,729
LTSYC (MCF)	20,743	25,078	21,472	17,633	19,818	23,463
% of LTSYC	73	63	50	69	66	80

LTSYC is a measure of the long-term timber productivity resulting from each alternative. It is the highest average yield from suitable lands consistent with multiple use objectives of each alternative and a specified management intensity. LTSYC is based on the assumption that the Forest is in a fully managed condition. It is a function of the amount and productivity of suitable acres, and the management intensity of prescriptions assigned and scheduled for an alternative. The maximum LTSYC for the Forest is 25,078 MCF.

No alternative achieves ninety percent of potential growth by the fifth decade. Using ECOSIM, all strata (analysis areas) were modeled as unmanaged except seedlings and saplings. Therefore, the growth for these strata were projected at only sixty percent of potential. In addition, any regeneration harvests in the third, fourth, or fifth decades do not contribute to the growth displayed in Table 114 above. In order to bring growth up to ninety percent of potential by the fifth decade, more acres need to be regenerated in the first decade.

All alternatives illustrate compromises made in silviculture and timber management. Growth in each alternative varies from fifty percent to eighty percent of LTSYC, in order to better resolve other Forest resource issues, primarily wildlife habitat and range.

Alternative E best resolves the commercial timber issue as growth rates are eighty percent of LTSYC.

Alternative B provides the poorest resolution of this component of the commercial timber issue, as growth rates are only fifty percent of LTSYC.

An irretrievable commitment of potential productivity is made in each alternative during the first decade only. Growth rates are less than potential, since management

emphasizes other resource outputs and objectives. No irretrievable commitments are made in subsequent decades since management revisions are made ten years following plan implementation.

Allowable Sale Quantity

Table 115 displays the irretrievable timber commitment of allowable sale quantity in the first decade for each of the alternatives compared to the high output in Alternative E.

Table 115. 10-Year Irretrievable Allowable Sale Quantity (ASQ) in MMCF Decade One by Alternative

	PA	A	B	C	D	E
ASQ						
Alt. Output	145.0	121.0	145.0	131.0	137.0	195.0
Irr. Comm.	50.0	74.0	50.0	64.0	58.0	0

Differences in ASQ outputs between the highest alternative and the other alternatives represent potential harvest volume foregone by the end of the first decade.

Age Class Distribution

Each alternative results in a different age class distribution by the twentieth decade. Distribution of age classes provides higher and more regular sustained yields, more variety and diversity of habitats, and a higher level of health and vigor in the Forest. Table 116 shows the age class distribution of the alternatives for the entire coniferous forest.

Table 116. Age Class Distribution at Decade 20 in M Acres (Suit. & Unsuit.)

Age Class	Alternative					
	PA	A	B	C	D	E
1-20	2.3	1.1	26.5	1.0	37.9	7.3
21-40	84.8	75.8	62.0	59.3	46.8	82.4
41-60	44.8	92.9	127.1	60.3	96.0	78.3
61-80	105.2	64.0	30.0	85.7	51.9	141.6
81-100	52.3	67.9	66.3	43.9	52.6	46.3
101-120	62.3	91.4	35.7	40.7	77.9	96.0
121-140	31.0	44.2	97.7	70.2	3.9	32.8
141-160	31.6	52.0	0	8.1	56.5	0
161-180	5.4	0	0	0	0	0
181-200	1.4	0	0	0	0	0
200-220	26.3	11.7	24.8	33.4	27.5	12.5
221-240	128.5	98.1	113.8	158.4	123.6	99.1
241-260	0	0	0	0	0	0
261-280	11.8	0	10.9	44.2	16.7	2.4
281+	87.4	75.9	80.4	89.5	83.6	76.3

Uniform distribution of age classes is not achieved in the next 200 years in any alternative. Alternative PA displays the best overall distribution of age classes. Progress is made toward that goal in all alternatives.

In decade 20, approximately one-fourth to one-third of the total coniferous acres are in age classes of 200 or older. These unsuitable and not appropriate lands together with acres managed for extended rotations provide assurance that minimum management requirements for old-growth are met and exceeded. However, these acres also contribute to an overall reduction in the health and vigor of the Forest, and increase the risk of epidemic insect and disease episodes.

There are no irreversible or irretrievable commitments related to age class distribution. Deficiencies that compromise resource objectives are corrected when the plan is redone each decade.

The Wildlife and Diversity section in this chapter also discusses the effects of age class distribution on habitat diversity.

Species Mix

Prescriptions developed for the tentatively suitable acres retain the current species mix of ponderosa pine and mixed conifer. Prescriptions applied to suitable and unsuitable lands perpetuate and improve the health and vigor of aspen and Gambel oak. Timber prescriptions applied to unsuitable pinyon-juniper stands perpetuate the species. Range, soil and watershed, and wildlife habitat improvement prescriptions permanently convert the acres treated in pinyon-juniper vegetative type to grassland.

An irretrievable commitment of resource is made in the first decade as acres of pinyon-juniper woodland are permanently converted to grasslands. Alternatives PA and C allocate the most acres to soil and watershed and wildlife habitat improvement. Alternative PA allocates 3,272 acres annually, and Alternative C allocates 3,057. Alternatives B, D, and E allocate between 1,600 and 2,100 acres per year to these projects. Alternative A, reflects current management; no acres of woodland are converted to grasslands through soil and watershed or wildlife habitat improvement projects.

Reforestation

Site preparation of the forest floor is done in conjunction with both natural and artificial reforestation. The objective of site preparation is to create conditions favorable for natural or artificial regeneration. Site preparation requires removing competing vegetation and exposing mineral soils.

Long-term timber productivity of sites depends in part on how quickly trees are established after harvest. Adequate site preparation improves seedling survival by providing a good soil medium and reducing vegetative competition.

Site preparation is accomplished by hand, mechanical, or chemical methods. Some site preparation occurs as part of logging and slash disposal activity.

The acres of site preparation vary by acres harvested (seed cut). Table 117 displays the site preparation acres by alternative for natural or artificial reforestation.

Table 117. Site Preparation Acres Per Decade for Decades 1-5 by Alternative

		Alternative					
	Decade	PA	A	B	C	D	E
Site preparation for Natural or Artificial Reforestation	1	21,757	21,182	0	3,189	12,794	28,934
	2	15,549	23,605	3,046	11,399	4,554	23,759
	3	20,376	49,299	19,307	18,695	21,291	14,924
	4	14,195	37,382	67,989	17,848	24,698	29,991
	5	19,799	39,364	10,104	9,066	45,704	31,290

Site preparation does not imply an irreversible commitment of resources to harvest the regenerated trees at a later date.

An irretrievable commitment of resource is made in the first decade if site preparation is not completed and natural or artificial regeneration of seedlings is delayed.

Tree planting is done where necessary after harvest, slash disposal, and site preparation are completed. Tree planting is also done in areas where regeneration is not expected to occur naturally. These areas include wildfire, blowdown, and stands prescribed for harvest that contain no mistletoe-free seed trees.

The primary environmental effect of planting is the rapid regeneration of trees. Planting also has a long-term effect on the productivity of the next generation of trees. Other species or genetically superior trees can be introduced, potentially reducing losses to insects and diseases, and producing more wood fiber in the long-term.

Although it is expensive, planting does not imply an irreversible commitment of resources to harvest the new generation of trees. The only irretrievable commitments associated with planting are seedling mortality or complete plantation failure. The fiber foregone during the first decade is not recoverable.

Even-aged Systems

Even-aged systems include intermediate cuts and regeneration cuts. Intermediate cuts are defined as all cuts in the life of a stand between regeneration harvests. The primary goals of intermediate cutting are to achieve desirable stand densities and increase the amount and value of timber products. A secondary goal is to create specific stand characteristics important for other resources, for example, old-growth habitat for wildlife and visual resources.

Intermediate cutting includes precommercial and commercial thinning. The primary objectives for these treatments are to reduce competition among crop trees, maximize growth, control species composition, and reduce or eliminate trees with insect or disease damage.

Table 118. Precommercial Thinning Acres Per Decade for Decades 1-5

Decades	Alternatives					
	PA	A	B	C	D	E
1	20,399	53,369	22,425	23,474	17,795	21,207
2	15,701	3,958	18,913	11,272	16,109	5,651
3	13,236	12,421	14,788	8,808	14,266	18,637
4	11,662	10,116	2,285	8,550	3,415	17,820
5	10,541	21,128	10,530	12,189	14,781	9,412

Acres of precommercial thinning vary by acres harvested (seed cut) and management emphasis. Precommercial thinning is applied when the stand is between twenty and forty years old. Table 118 displays the average decadal acres of precommercial thinning planned for the first five decades by alternative.

All alternatives, except Alternative A, display a reduction in precommercial thinning during the first decade from current levels. This reduction illustrates that backlog acres are completed in the first decade, and precommercial thinning projects are concentrated in timber sale cutting units only. Alternative PA displays a better balance of precommercial thinning over the first five decades than other alternatives.

Acres of commercial thinning vary by acres harvested, and management emphasis. Commercial thinnings are not applied until the stand is forty years old or older. Table 119 displays the average decadal acres of commercial thinning planned for the first five decades, by alternative.

Table 119. Commercial Thinning Acres Per Decade for Decades 1-5

Decade	PA	A	B	C	D	E
1	64,337	47,758	93,631	73,283	55,310	38,117
2	53,904	92,412	89,084	49,355	53,696	45,224
3	35,982	26,006	98,844	36,219	32,735	49,806
4	50,986	97,651	30,649	47,267	50,916	27,895
5	5,656	25,413	40,798	32,664	28,659	49,535

Acres allocated to intermediate cutting in Planning Period 1 vary from 3,812 acres per year in Alternative E to 9,363 acres per year in Alternative B. This range represents allocations from slightly below the average acres treated under current managemert, to almost twice the current level of treatment in Alternative B.

The major short-term effect of thinning is increased fire hazard to the residual stand from slash created. This adverse effect is mitigated through fuel treatment.

Increase in the general health and vigor of the residual stands is both a short-term and a long-term effect.

Although thinnings are investments in a stand to improve yield over the entire rotation, thinnings are not an irreversible commitment to harvest timber in the future.

Regeneration cuts are designed to establish a new stand of trees. The only regeneration cut considered is a shelterwood seed cut. The acres of seed cut at or beyond culmination of mean annual increment (CMAI) are affected by the existing age class distribution of suitable land, and the management emphasis. Table 120 displays acres of seed cut for the first five decades.

Table 120. Seed Cut Acres Per Decade by Alternative

Decade	Alternative					
	PA	A	B	C	D	E
1	21,757	30,260	0	5,315	22,547	61,468
2	38,872	33,721	7,616	28,498	11,385	59,399
3	37,469	70,427	35,100	40,630	49,271	31,375
4	31,202	53,403	122,018	38,869	48,768	49,984
5	36,324	56,234	18,732	15,110	78,588	54,681

Alternative E prescribes the most acres to shelterwood seed cutting, 61,468 acres in the first decade from the total suitable forest. By applying this timber management emphasis, approximately thirteen percent of the suitable acres are regenerated during the first decade. Alternatives PA, A, C, D, E vary from a high of thirteen percent of the suitable acres regenerated per decade in Alternative E, to a low in Alternative C of two percent per decade. Alternative B regenerated no acres by seed cutting in the first decade. Under this alternative emphasis, shelterwood final removal harvest prescriptions were selected instead of seed cutting, because associated reforestation costs are less, and timber benefit values greater. A range of five percent to twenty percent of the suitable acres allocated to regeneration harvest per decade is recommended to improve wildlife habitat and diversity.

Shelterwood seed cutting provides the best opportunity to improve the long-term productivity of timber stands on the forest. age class balance is improved sooner under alternatives that allocate more acres to regeneration harvest. Insect and disease pests are controlled more rapidly, and fire hazards are reduced. In addition, survival of seeds and seedlings that require partial shade during early development is improved.

There are no irretrievable commitments implied with seed cutting to harvest the residual stand or the regenerated stand at a later time. A reduction in visual diversity results under Alternative A from timber harvest activities along road corridors that may be considered visually sensitive in the future from increased recreation use. This short-term adverse effect is reduced after the regenerated stand becomes established.

Final removal cutting is prescribed for stands ten to thirty years following seed cutting. Final removal cutting is also prescribed for existing seedling and sapling stands with a partial overstory.

Table 121. Final Removal Acres Per Decade by Alternative

Decade	Alternative					
	PA	A	B	C	D	E
1	30,223	45,032	28,354	20,635	26,989	53,421
2	7,512	9,693	3,984	8,571	7,578	31,877
3	44,121	30,260	19,922	20,245	49,416	26,973
4	38,872	33,721	16,381	28,498	48,723	62,017
5	37,469	70,427	123,578	40,630	10,892	31,375

Alternative E allocates 53,421 acres per decade to final removal cutting, the highest allocation of any alternative. These acres represent eleven percent of the total suitable forest land. Alternative C allocates 20,635 acres to final removal cutting, the fewest of any alternative. These acres represent six percent of the total suitable forest land. The acres allocated to final removal cutting for the alternatives fall within the recommended range of acres that need to be regenerated per decade to enhance wildlife habitat, improve diversity, and increase forage production.

There are no irretrievable commitments made with final removal cutting, as long as adequate stocking of regenerated seedlings exists at the time of the removal harvest.

Like seed cutting, a reduction in visual diversity results under Alternative A from removal harvest activities along road corridors that may be considered visually sensitive in the future from increased recreation use. This short-term adverse effect is mitigated since the regenerated stand is established and provides cover.

Old-Growth

Table 122. Estimated Old-growth Acres by Vegetative Type

Vegetative Type	Total Acres	Estimated Range of Existing Acres of Old-growth
Tentatively Suitable:		
Ponderosa Pine	357,180	17,859 (5%) - 35,718 (10%)
Mixed Conifer	135,256	13,526 (10%) - 20,288 (15%)
Unsuitable:		
Ponderosa Pine	168,863	15,197 (9%) - 33,773 (20%)
Mixed Conifer	7,248	652 (9%) - 1,450 (20%)
Pinyon-Juniper Woodland	685,563	102,834 (15%) - 137,113 (20%)

Minimum management requirements specify that at least three percent of the capable forest lands throughout the Forest be retained in old-growth. Table 122 displays an estimated range of existing acres in each vegetative type that qualify as old-growth under current Region 3 guidelines.

Old-growth prescriptions on tentatively suitable acres actually exhibit old-growth characteristics for only 33 percent of their rotation. Therefore, for every acre needed in old-growth, three acres are allocated to old-growth management. Standard silvicultural practices are applied to the stand until CMAI. The seed cut is then deferred until the stand is 210-240 years old. Maintaining the overstory for an additional 60-100 years will create two-storied stands with many old-growth characteristics. Acres are allocated to extended rotations to address wildlife concerns and accomplish specific wildlife habitat objectives.

Table 123 displays the tentatively suitable acres allocated to extended rotations, by alternative. These acres allocated to extended rotations are in addition to the estimated old-growth acres displayed in Table 122.

Table 123. Acres Allocated to Extended Rotations by Alternative

	Alternatives					
	PA	A	B	C	D	E
	65,552	14,698	29,845	68,535	44,103	14,698
Percent of Tentatively Suitable	13%	3%	6%	14%	9%	3%

Minimum management requirements are met or exceeded in Alternatives PA, C, and D. Alternatives A, B and E do not meet minimum management requirements, since nine percent of the suitable acres must be allocated to extended rotations to maintain three percent with old-growth characteristics.

The major short-term and long-term effects of allocating acres to extended rotations are decreases in harvested timber volumes. The short-term effect is only for stands currently close to meeting old-growth characteristics that are not harvested in the first decade. The long-term effect of allocating acres to extended rotations is the loss of harvested timber volume by delaying the seed cut from 110 years or 120 years (stand age) to 210 to 240 years stand age.

Allocating acres to old-growth is not an irreversible commitment of resources. There is an irretrievable growth loss in the first decade for these stands, however.

Health and Vigor

Health and vigor of timber stands is affected primarily by acres allocated to timber harvest, and the timber management intensity applied to those acres. Growth rate and susceptibility to insects and diseases are measures of stand health and vigor.

Alternative E best addresses the issue of stand health and vigor. Ninety-nine percent of the tentatively suitable acres are allocated to timber harvest, fewer acres are allocated to extended rotations, and more stands are treated with intermediate and regeneration harvests than other alternatives.

In descending order of resolution of this component of the commercial timber issue, the alternatives are E, B, A, PA, D, C.

FUELWOOD

Under all alternatives the primary fuelwood sources are green pinyon and juniper, and coniferous residues from commercial harvests. Fuelwood is harvested from acres allocated to soil and watershed, and wildlife habitat improvement projects, and timber management overstory modifications. Secondary quantities of Gambel oak and aspen are harvested from acres allocated to wildlife habitat improvement prescriptions, only.

Table 124 displays the total annual fuelwood produced for planning period 1 by alternative. Fuelwood harvests of green pinyon-juniper and coniferous residues from overstory modification are displayed separately.

All alternatives except A provide for intensive inventory and silvicultural examination of the pinyon-juniper woodland, that is useful for long-range planning and operational planning.

All alternatives provide enough total fuelwood volume to meet the estimated future demand for the first decade. To meet this demand, the alternatives provide different amounts of the preferred fuelwood, green pinyon and juniper, and supplement this output with coniferous residues from timber harvest. None of the alternatives provide enough preferred fuelwood to meet estimated total demand for the first decade. Alternative PA, B, and D provide the most green pinyon and juniper fuelwood.

Table 124. Total Annual Fuelwood Produced, Planning Period 1- MMBF

Decades	Alternatives PA	A	B	C	D	E
Green Pinyon-Juniper						
1	8.8	5.2	9.8	7.5	8.9	5.1
2	8.8	5.2	9.8	7.5	8.9	5.1
3	8.8	5.2	9.8	7.5	8.9	5.1
4	8.9	5.2	9.9	8.4	8.9	5.4
5	8.9	5.2	9.9	8.4	8.9	5.4

Table 124. (cont.) Total Annual Fuelwood Produced, Planning Period 1- MMBF

Decades	Alternatives PA	A	B	C	D	E
Coniferous Residues Available from Overstory Modifications						
1	8.2	7.0	8.2	7.4	7.8	11.2
2	9.1	8.8	9.1	8.0	9.3	12.9
3	9.0	12.9	9.8	8.0	11.0	11.6
4	8.6	12.3	10.4	8.6	10.8	12.3
5	9.0	12.8	10.5	8.5	10.6	12.0
Total per year Decade 1	17.0	12.2	18.0	14.9	16.7	16.3

Table 125. 10-year Irretrievable Green Pinyon-Juniper Fuelwood Commitment (MMBF)

Alternative	PA	A	B	C	D	E
Alternative Output	88	52	98	75	89	51
Irretrievable Commitment	10	46	0	23	9	47

All alternatives provide additional coniferous residues beyond that needed to meet estimated future demand. This additional volume is available if demand for fuelwood increases more rapidly than expected.

Wildfire fuel loading is reduced below current levels in all alternatives.

Irreversible and Irretrievable Commitments

The irretrievable commitment of the preferred fuelwood resource is measured by comparing the pinyon-juniper fuelwood output for planning period 1 to the highest fuelwood output. Table 125 displays the results of this analysis.

WATER YIELD

Currently the Kaibab National Forest produces an estimated annual water yield of 302,653 acre-feet. Only one percent of this water is put to beneficial use on the Forest with the vast majority contributing to groundwater recharge or runoff. The majority of water produced on this Forest occurs in the ponderosa pine/mixed conifer areas and also within the large grassland communities.

Increases in water yield over current occur in all alternatives except Alternative C. However, these increases are not significant. Water yield by planning period is summarized in Table 126.

Table 126. Average Annual Water Yield - M Acre-Feet

Period	Alternative PA	A	B	C	D	E
1	302.5	302.7	302.5	302.8	302.7	302.5
2	300.9	301.4	302.8	300.3	300.8	302.6
3	299.6	301.2	302.9	298.5	299.9	304.8
4	298.9	299.8	301.0	295.2	298.7	304.9
5	302.7	301.9	303.9	298.5	304.9	310.9

The proposed action provides for only a 200 acre-foot increase by the end of the fifth period. Other alternatives providing increases in water yield listed in order from high to low are E, B and D. Water yield under Alternative C is approximately 2,400 acre-feet below current through the fifth period. Alternative E provides for the highest water yield increase through the fifth period which is approximately 8,400 acre-feet. Water yield does not vary in any alternative by more than one or two percent from current.

Water Rights

The proposed action and all other alternatives require the acquisition of water rights on all new and existing developments needed for livestock and wildlife. Additional water rights are needed for alternatives which provide for better livestock distribution through water developments to achieve higher range capacities. Water rights are obtained by appropriation or by purchase in accordance with state laws. Also, water rights currently held by the United States are managed so they are consistently put to beneficial use at their present locations or transferred to more efficient locations.

Water Quality

Water quality problems resulting from point sources will continue to be localized and sporadic. The primary problem is the waste water treatment plant located on the North Kaibab Ranger District at Jacob Lake. This point source of pollution will be corrected when the wastewater system is upgraded.

The Jacob Lake treatment plant is the only known point pollution source which sometimes violates the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977. Waste water from developed recreation and administrative facilities is disposed of in treatment plants approved by the state in all alternatives.

The potential for local non-point pollution occurs on suitable timber lands in all alternatives. The use of Best Management Practices (BMP's) such as activity scheduling, improved road locations, road obliteration and the adherence to the watershed clauses in the timber sale contract prevents or mitigates serious watershed impacts. Sediment load and water temperature are the only water quality parameters likely to change under all alternatives. Soil movement in the suitable timber lands never increases above six percent over background. Alternative PA results in the second lowest estimated soil erosion rate from timber sale activities. Only Alternative C has lower values in the suitable timber allocation zones. Significant impairment of land productivity from soil erosion does not occur under any alternative.

In the woodland vegetative zone, the acreage contributing to non-point pollution sources decreases in all alternatives. The alternatives improve the watershed condition thereby reducing the land area contributing to this problem.

Flood Risk

Flood risk, both local and downstream, does not vary significantly by alternative. With improvement of groundcover conditions in the pinyon and juniper zone, the severity and probability of damaging peak flows declines. Flood events will continue although these are not the results of management activities.

Watershed Condition

Improvement in watershed condition occurs in all alternatives and is the result of both direct treatments including fuelwood harvests and subsequent seeding and indirect effects from balancing permitted livestock use with capacity.

Direct treatment of unsatisfactory watershed acres is presented in Table 127 and Table 128. Table 127 represents acres which are treated by the commercial fuelwood program, and Table 128 reflects improvements in watershed condition through road obliteration. Table 128 does not include acres of road closures or road abandonments.

Table 127. Watershed Improvement Acres for Planning Periods 1 through 5

Planning Period	Alternative PA	A	B	C	D	E
1	7491	0	7824	12,647	6546	3655
2	7491	0	7824	12,647	6546	3655
3	7491	0	7824	12,647	6546	3655
4	7842	0	8060	16,018	6546	4674
5	7842	0	8060	16,018	6546	4674

Treatments are accounted for through the first five periods except for road obliteration which carries out into the latter periods until the identified acreage is completed. All alternatives, except for A and E, have sufficient direct treatments to improve watershed condition substantially. Although Alternative PA is not the highest investment with respect to total watershed dollars expended on improvement work, due to the integrated nature of the prescriptions, fuelwood, wildlife and range treatments pick up the necessary acreage and account for the vast improvement in overall watershed conditions.

Table 128. Road Obliteration Acres for Planning Periods 1 through 5

Planning Period	Alternative PA	A	B	C	D	E
1	314	155	289	648	252	282
2	314	155	289	648	252	282
3	314	155	289	648	252	282
4	199	155	232	0	252	9
5	199	155	232	0	252	9

Not only does the initial treatment and subsequent management change influence improvement in watershed condition within all of the alternatives, but also the retreatment and maintenance of the treated sites. Table 129 displays the maintenance acres under the alternatives.

Table 129. Watershed Maintenance Acres for Planning Periods 1 through 5

Planning Period	Alternatives PA	A	B	C	D	E
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	7438	0	7228	11,997	6503	3655
4	7438	0	7228	11,997	6503	3655
5	7438	0	7228	11,997	6503	3655

All alternatives have a positive impact on watershed condition. However, only Alternatives PA, B, C and D, provide for enough soil and water improvement work in conjunction with range, wildlife and fuelwood to move all watersheds from unsatisfactory to satisfactory. Alternatives A and E have gradual improvement although the rate is not sufficient enough to change condition classes on all

watersheds. Changes in unsatisfactory watershed conditions from both direct and indirect effects are displayed in Table 130.

Table 130. Change from Existing Unsatisfactory Watershed Condition by Alternative

Planning Period	Percent Change by Alternative					
	PA	A	B	C	D	E
1	-10%	-6%	-11%	-9%	-10%	-6%
2	-21%	-12%	-23%	-18%	-22%	-12%
3	-33%	-19%	-40%	-27%	-39%	-18%
4	-44%	-26%	-59%	-38%	-56%	-25%
5	-56%	-33%	-76%	-49%	-74%	-32%

As Table 130 indicates, all alternatives show substantial improvement in watershed condition with Alternatives B, D, PA and C being the best.

Soil Loss

Soil erosion, like watershed condition, exhibits lower rates for all alternatives. Table 131 exhibits the change in soil loss from existing levels.

Table 131. Change from Present Soil Loss by Alternative

Planning Period	Percent Change by Alternative					
	PA	A	B	C	D	E
1	-3%	-2%	-3%	-3%	-3%	-2%
2	-7%	-4%	-7%	-5%	-7%	-4%
3	-10%	-6%	-12%	-8%	-12%	-6%
4	-13%	-8%	-19%	-12%	-17%	-8%
5	-17%	-10%	-23%	-15%	-22%	-10%

Soil loss decreases under all alternatives. The greatest decreases occur under Alternatives B, D, PA and C with the least in Alternatives A and E. The lowering of soil erosion rates results from direct watershed, fuelwood, and wildlife improvement work which improves ground cover conditions. Balancing permitted livestock use with capacity also contributes to lower soil erosion rates.

Cumulative effects of management activities on the soil and water resources of the Forest are negligible in all alternatives. Timber, range, wildlife and watershed treatments in the planning alternatives reduce soil erosion and sedimentation, and improve water quality and forage quantity, particularly in the pinyon and juniper vegetative type. Watershed conditions of lands suitable for commercial timber production are improved through integrated stand management practices. Water yield does not vary significantly under any alternative.

Irreversible and Irretrievable Commitments

Irreversible soil loss in all alternatives is held to a minimum through the application of watershed clauses in timber sale contracts and by balancing permitted livestock numbers with capacity. Based on forage responses following revegetation projects of rangelands, overall loss in site productivity in the woodland over the past fifty years is estimated at less than ten percent. Alternative PA provides for one of the best mix of prescriptions to reduce soil erosion in the woodland zone and provides for further reductions in soil erosion on lands suitable for commercial timber production. There are no irretrievable commitments of watershed resources in any alternative.

MINERALS

Minerals management issues and concerns address the need to ensure access for mineral exploration and development while providing for adequate protection of special resource values. The alternatives affect the accessibility of the minerals resource by varying the acreage available for mineral exploration and development, and through the application of various surface use and occupancy restrictions.

Minerals management program funding and projected mineral outputs under the various alternatives are displayed in Table 132.

Table 132. Average Annual Minerals Management Program Funding and Projected Mineral Outputs for Planning Period 1 by Alternative

	Alternatives					
	PA	A	B	C	D	E
Minerals Budget	$74,807	$69,819	$89,328	$72,057	$91,205	$70,498
Acres leased for Oil and Gas	138,418	70,011	138,418	138,418	138,418	138,418
Uranium Production in Pounds of Processed Uranium	750,000	750,000	750,000	750,000	750,000	750,000
Cinders and Building Stone Production in Tons	146,400	145,900	151,000	145,500	151,600	145,100
Value of Locatable Mineral Production	$25,900	$25,900	$25,900	$25,900	$25,900	$25,900

* Acres under oil and gas lease reflect pending lease applications for approximately 70,000 acres.

Uranium outputs reflect the operation of one underground mine at peak production based on ore grade of .60 percent and average daily ore production of 250 tons for 250 days per year.

Mineral material production includes in-service, other agency, commercial and personal-use of common varieties of cinders, sand, limestone, clay and building stone.

Locatable mineral outputs reflect the in-place value of building stone production from mining claims.

The effects of the proposed Canyon uranium mine are evaluated and addressed in a separate environmental impact statement.

Alternatives PA, B, C, D and E provide for increased minerals management program funding above the current level reflected under Alternative A. Minerals management funding under all alternatives is adequate for timely analysis and processing of locatable and leasable mineral prospecting, exploration, leasing and development proposals. Minor differences in budget levels may affect the timeliness of response to mineral proposals to some degree.

Projected outputs for all mineral commodities are similar under all alternatives. The reduced acreage under oil and gas lease for Alternative A represents the current status of the Forest leasing program. Projected uranium, other locatable minerals and common variety mineral material outputs hold steady for all alternatives.

Acres of proposed mineral withdrawals vary by alternative according to management emphasis of certain areas with special resource values and uses. Areas withdrawn from mineral entry under existing authorities are not affected by any alternative.

Additional withdrawals are proposed under all planning alternatives. Alternative E affords the greatest protection of special resource values through mineral withdrawals. Alternative A only includes provisions for the withdrawal of the Bill Williams ski area and Moqui Lodge concession. Mineral activities may impact visual resources in several roadside zones under Alternatives A, B and D.

Proposed operating and surface occupancy restrictions vary substantially in each alternative. Operating constraints and proposed withdrawals are site specific in nature and, therefore, not expected to greatly influence projected mineral outputs under any alternative. However, additional operating costs may be incurred under most alternatives in proportion to the magnitude of restrictions applied to mineral activities.

Table 133. Additional Acres of Mineral Withdrawals by Alternative*

Special Resource Value Protected	Alternative PA	A	B	C	D	E
Developed Recreation Sites	2,789	771	2,789	2,789	2,789	2,789
Acquatic Habitats	320	0	160	320	0	1,120
National Register Sites	20	0	20	20	20	20
T & E Plant Habitat	240	0	240	240	240	240
Visually Sensitive Areas	2,112	0	0	2,112	0	3,422
Research Natural Areas	300	0	300	300	300	300
Total Acreage Proposed for Withdrawal	5,781	771	3,509	5,781	3,349	7,891

* Proposed withdrawals restrict locateble mineral entry only. Surface use and occupancy controls available under leaseble mineral authorities provide adequate protection of special resource values and uses. Existing withdrawals and special land designations restrict mineral activities on 730,376 acres [see Table 60].

The degree of mineral restrictions considered under the planning alternatives can be described in relative terms of high, moderate and low. The high restriction level imposes numerous seasonal and permanent operating and occupancy constraints to protect special resource values including important wildlife habitats, recreation, administrative and special use sites, visually sensitive areas, SP and SPM ROS areas, sensitive soil and National Register sites. The moderate level of restrictions protects special values and uses in similar resource categories, but to a lesser extent than the high restriction level. The low restriction level maximizes the area available for mineral exploration and development with minimum constraints to protect special resource values.

Potential impacts of mineral activities on other resources can be qualitatively described based on the degree of restrictions imposed on lands open to mineral entry under each alternative, as shown in Table 134.

Table 134. Allocation and Degree of Mineral Restrictions on Lands Open to Mineral Entry by Alternative

Degree of Restrictions	Proportion of Total Forest Area Allocated by Alternative					
	PA	A	B	C	D	E
High Level of Restrictions	27%	0	6%	13%	0	31%
Moderate Level of Restrictions	54%	42%	21%	78%	20%	65%
Low Level of Restrictions	19%	58%	73%	9%	80%	4%

Under all restriction levels, the constraints imposed on locatable mineral activities pertain to the prospecting and exploration phase of operations. Constraints generally affect timing of operations. The capability of the Forest Service to influence operations during the mine development and production phases is limited to review of mining plans of operations to ensure reasonable protection of surface resources.

Special resource values and uses have the greatest potential to be impacted adversely by mineral activities under Alternatives B and D. Mineral constraints are relaxed over a large portion of the Forest in these alternatives. Important wildlife habitats may be lost or severely impacted during primary use seasons from both locatable and leasable mineral activities.

Alternatives PA, C and E afford greater protection of special resource values and uses than the current level of protection reflected under Alternative A. Locatable prospecting and exploration activities proposed in and adjacent to important wildlife habitats are restricted during primary seasons of use under these alternatives. Special surface use stipulations of oil and gas leases provide protection of most areas with special resource values during all phases of leasable mineral activities. Common variety mineral material removals are prohibited in most visually sensitive roadside corridors, SP and SPM ROS areas and adjacent to important wildlife habitats.

Potential cumulative effects of both leasable and locatable developments primarily involve social and economic impacts. Cumulative impacts to wildlife and visual resources from mineral developments are considered insignificant when viewed in light of the small area likely to be directly impacted through mining and oil and gas production activities and mitigation measures available to offset impacts on wildlife habitats.

The extent of potential cumulative effects of prospecting and exploration activities, however, is also a function of the relative degree of mineral restrictions under each alternative. Potential cumulative effects to wildlife resources from prospecting and exploration activities are greatest under Alternatives A, B and D. Seasonal restrictions imposed on locatable mineral activities and special surface use stipulations of oil and gas leases under Alternatives PA, C and E effectively minimize potential cumulative impacts on important wildlife habitats.

Reserved and outstanding mineral rights and active mines not covered by Secretary of Agriculture regulations are not affected by any of the alternatives.

Irreversible and Irretrievable Commitments

Irreversible commitments of mineral resources occur when minerals are extracted. Irretrievable commitments include the potential loss of wildlife habitat due to long term mining and oil and gas production activities and foregone opportunities for mineral production on areas withdrawn from mineral entry. Both of these irretrievable commitments are considered insignificant based on the low probability of large scale mineral developments, mitigation measures available to reduce impacts on wildlife habitats and the low probability for economic mineral occurrences on proposed withdrawal areas.

FIRE PROTECTION

Wildfire potential is the product of fire risk, fire hazard and fire protection. Fire risk is a function of human activity. With the exception of Alternative A, which represents the current situation, all of the alternatives provide for an increase in recreation use, and, therefore, an increase in fire risk. The recreational use projections indicate that the difference between alternatives, however, is not significant in terms of fire risk.

Fire hazard is primarily the amount and arrangement of the fuels, both natural and activity created. This factor is effected by the creation of fuel as well as the treatment of fuel. Fuel buildup from management activities is partially mitigated by activity funded fuel treatment. The amount of treatment varies with the management intensity and the resource damage potential. In addition, fire management funds are used to treat areas of unusually high hazard. Table 135 displays fuel treatment with fire management funds for each alternative.

Table 135. Annual Acres of Fuel Treatment with Fire Management Funds.

		Alternatives				
	PA	A	B	C	D	E
Acres	2600	1800	2800	2100	3300	1400

Fire protection is the ability of the Forest to prevent, detect and suppress wildfires. This factor is generally measured by the amount of dollars dedicated to presuppression activity. Alternative D provides the most protection followed by Alternatives B, C, PA, A and E in decreasing order.

By combining risk, hazard and protection, the average annual burned area and the net value change (benefits and losses) to the resources on these areas can be predicted. Table 136 summarizes the predicted costs, losses and burned area for each alternative. Except for presuppression and fuel treatment, the values shown are calculated using the Kaibab Fire Management Analysis (July 1984).

Table 136. Summary of Average Annual Protection Costs, Losses, and Burned Area by Alternative.

		Alternatives				
	PA	A	B	C	D	E
Presuppression ($M)	1293	1270	1402	1306	1486	1194
Fuel Treatment ($M)	101	71	112	90	132	55
Suppression ($M)	469	427	421	446	372	561
Net Value Change ($M)	212	220	181	208	157	455
Cost Plus Loss ($M)	1972	1978	1989	1975	2004	2000
Burned Area (Acres)	414	440	358	403	319	527

The preferred alternative provides a relatively high level of fire protection and therefore reduces the potential for significant adverse environmental effects. In addition, many adverse effects are mitigated by applying the procedures outlined in the Forest Service Handbook, "Burned-Area Emergency Rehabilitation".

Adverse environmental effects which cannot be avoided are:

temporary reduction in air quality due to wildfire;

temporary to long-term reduction in visual quality, water storage, and recreation opportunities due to wildfire in proportion to the size and intensity of each fire; and

soil movement and decreased watershed condition due to high intensity burns.

Long-term productivity of soil and water resources and the uses dependent upon these resources can be effected porportionately with the size of high intensity wildfire. Soil movement is irreversible in some instances, and resource uses lost as a result of lowered productivity are irretrievable.

INTEGRATED PEST MANAGEMENT

Insects and diseases play natural roles in the environment and are considered destructive only when they reach epidemic population levels or compromise the long-range management objectives for the timber stands. Insect and disease pests are managed through cultural, biological and chemical treatments. Special attention is given to western spruce budworm, bark beetles, dwarf mistletoe and root rots in all forested areas.

Insect and disease levels are monitored to identify their potential threat to adjacent stands. Present spruce budworm and dwarf mistletoe infestation levels threaten large acreages of timber.

The implementation and timing of certain silvicultural practices, i.e., thinning, sanitation cutting and maximum utilization of the tree, play a decisive role in managing pest populations. Chipping, fuelwood gathering, lopping, scattering or burning unutilized slash and logging debris are additional tools used to prevent pest buildups. Pesticides and biological materials may be utilized to control increases in insect populations in high value areas, such as campgrounds, or when other resource values are threatened. The health and vigor section in this chapter also discusses the relative risks involving insects and diseases for each alternative.

Dwarf mistletoe in ponderosa pine and spruce budworm in the mixed conifer forest types are primary problems. The control of dwarf mistletoe is accomplished in all alternatives by cutting infected trees during all stand entries to eliminate or minimize infection of the existing stand and subsequent regenerated stands. Infected stands receive priority for cultural treatments. Control of spruce budworm is accomplished in all alternatives through regeneration of mature stands and in intermediate entries through reduction of stocking levels and favoring ponderosa pine, Engelmann spruce and Douglas fir. All alternatives provide for reduced losses on suitable timber lands as stands are brought under management.

Further control of insect and disease pests is accomplished for each alternative as stand sizes are reduced, and diversity is improved as stands are juxteposed both spatially and temporally.

The alternatives that treat the most acres through intermediate and regeneration harvest are most effective in controlling insects and disease. In descending order of acres treated they are: E, A, B, PA, D and C. The alternatives include regeneration or seed cuts in younger stands where growth increment has culminated earlier than normal due to the effects of the pests.

Standards and guidelines for applicable management areas provide for monitoring insect and disease pests through aerial surveys and resource inventories. Integrated pest management practices are applied under all alternatives. Monitoring is most important under alternatives having the least vegetation manipulation such as Alternatives C and D.

The application of appropriate silvicultural methods to control insects and diseases increase the long-term productivity of the Forest from the standpoint of retrievable resources.

Irretrievable and Irreversible Commitments

Reduced wood fiber production from suitable timber lands because of insect and disease loss is an irretrievable loss in the first decade. See Forest Pest Management Report #R3 85-13.

Since accurate prediction of insect epidemics is not possible, irretrievable effects of the various alternatives, other than reduced wood fiber production, cannot be predicted.

AIR QUALITY

The primary and only significant source of air pollution from Forest activities is wildland fire, including prescribed fire as well as wildfire.

Wildfire air pollution is characterized by extremely high emission rates of short duration. Although the timing and location of these fires cannot be controlled, they generally occur during unstable atmospheric conditions which causes rapid mixing and dispersal of the smoke.

Most prescribed burning, on the other hand, is conducted when the atmospheric conditions are more stable and smoke dispersal is not as rapid. The emission rate from this type of burn is much less and the burns are planned and executed to facilitate smoke dispersal and minimize adverse impacts.

The adverse effects of smoke from wildland fire are transitory and normally highly localized. Short-term, direct effects of these activities will not contribute to the extended impairment of visibility within the designated Class I areas in and adjacent to the Forest, nor to a "Significant Deterioration" in the quality of the air resource. Table 137 displays the acreage burned annually by both prescribed fire and wildfire.

Table 137. Estimated Area Burned by Wildland Fires Annually in M Acres.

		Alternatives				
	PA	A	B	C	D	E
Wildfire	0.4	0.4	0.4	0.4	0.3	0.5
Prescribed Fire						
Timber Harvest	4.3	4.2	4.3	3.7	3.7	5.2
Backlog Fuels	2.6	1.8	2.8	2.1	3.3	1.4
Range & Wildlife	7.0	0.0	4.8	6.8	4.6	5.0
Total Burned	14.3	6.4	12.3	13.0	11.9	12.1

The preferred alternative prescribes more than twice the amount of burning as that in current. This in itself is not significant to air quality since state requirements must still be met and more than twice this amount was burned in 1980 without serious impacts to air quality. It may be very difficult, however, to sustain this high level of burning year in and year out because of weather conditions.

FACILITIES

Transportation System

The alternative objectives effect the system design by changing the miles of roads reconstructed, constructed or closed, and the maintenance levels of the Forest Development Roads.

The goal for the transportation system is to provide safe, cost effective roads for Forest users consistent with land management objectives. The Forest currently has 946 miles of arterial and collector roads and 5,744 miles of local roads and travelways.

Timber harvest generates most road development on the Forest. Timber purchasers receive credits for reconstructing or constructing roads needed to access the sale areas. Timber road reconstruction and construction miles change directly as timber harvest volumes change by alternative. Any new construction involves local roads directly associated with timber harvest. New construction by alternative is less than 5 miles per year to access timber for harvest in the first decade. New construction approaches zero miles by the end of the second decade when first entry into sale areas is completed. Also, local roads, identified through transportation analysis as not needed for Forest administration or timber harvest, are obliterated and taken off the transportation system after the ground is returned to resource production.

Non-timber purchaser road projects are funded by capital investment dollars. This funding is mainly for arterial and collector road reconstruction. No alternative requires new construction of arterial or collector roads.

Table 138. Average Annual Miles of Road Reconstruction and Construction by Alternative

Purchaser Credit by Planning Period	Alternatives PA	A	B	C	D	E
Planning Period 1	563	561	583	515	533	766
Planning Period 2	510	640	522	439	425	751
Planning Period 3	533	689	633	458	606	657
Planning Period 4	567	831	737	562	731	731
Planning Period 5	462	824	835	498	638	714
C.I. All PP's	254	246	266	249	256	179

As shown in Table 138, all alternatives except E provide funding to reconstruct roads at a rate commensurate with their rate of deterioration from use and weather. The arterial and collector road system is reconstructed on about a 30-year rotation. At the time of reconstruction, work is required to reestablish drainage structures, rebuild the subgrade, upgrade the running surface and meet current safety requirements. These funding levels protect the majority of the road investment and have a minimal impact on the surrounding resources. In Alternative E, the road system is reconstructed in a forty-year period. The same type of road work is required as in the other alternatives, however, there are some roads that do not meet management needs, do not provide user comfort and economy, and restrict access to low clearance vehicles and during wet weather. This road disinvestment also causes some resource damage.

Road Management Planning will be completed in FY 87. Once implemented, this process identifies roads needing drainage, subgrade and surface improvements for administration and resource access; seasonal closures needed to protect road investments, minimize resource damage and reduce stress on wildlife; road obliteration needs based on resource access requirements and potential for resource damage, and; appropriate maintenance levels for all roads to meet management objectives. An estimate of the total miles of road on the transportation system by alternative for planning periods one through five is displayed in Table 139.

Table 139. Total Miles of Forest Development Roads by Alternative

Planning Period	Alternatives PA	A	B	C	D	E
Planning Period 1	6359	6457	6379	6163	6388	6391
Planning Period 2	6027	6223	6067	5635	6085	6091
Planning Period 3	5695	5989	5755	5107	5782	5791
Planning Period 4	5422	5755	5472	4913	5479	5631
Planning Period 5	5149	5521	5189	4718	5176	5471

All alternatives show minor increases in road maintenance funding over current levels. This is because funds are appropriated based partly on functional outputs of timber and recreation. Alternatives A and C continue to maintain roads at current levels; providing user safety, access for high clearance vehicles on low use roads, access for low clearance vehicles and some user comfort and economy on higher use roads, and a sign maintenance program that provides adequate safety and informational signing. Alternatives PA, D and E provide better timber resource access because of the higher timber outputs, surface replacement on a twenty-year cycle and improved

signing for safety and information. Alternative B provides surface replacement on a ten-year cycle in addition to the same work performed under the other alternatives. All alternatives provide sufficient funding to protect major road investments and minimize impacts on resources.

Costs not shown in Table 140 are those associated with maintenance performed by timber purchasers commensurate with their use; maintenance on 139 miles of state highways included as arterial roads on the Forest's Transportation System; 120 miles of system roads maintained by the County, and; 233 miles of system roads maintained by private and commercial users. This situation is not expected to change significantly by alternative. County and other users are encouraged to assume their continued maintenance responsibilities.

Generally, roads have not been a concern for causing resource damage from erosion and sedimentation on the Forest. Road densities are a concern, mainly in timber harvest areas, because of increased wildlife harassment. In all alternatives, road management planning identifies specific roads not needed for resource access, and as funds become available, removes them from the system by mechanical or passive means.

Table 140. Average Road Maintenance Funding in M$ per Planning Period

Alternative	PP1	PP2	PP3	PP4	PP5
PA					
FA&O	2569	2569	2569	2569	2569
Timber	2250	2505	2402	2351	2462
Recreation	934	947	964	982	991
TOTAL	5753	6021	5935	5902	6022
A					
FA&O	2501	2501	2501	2501	2501
Timber	1923	2413	3535	3373	3500
Recreation	915	915	915	915	915
TOTAL	5339	5829	6951	6789	6916
B					
FA&O	2746	2746	2746	2746	2746
Timber	2235	2495	2685	2859	2871
Recreation	875	905	905	905	905
TOTAL	5856	6146	6336	6510	6522
C					
FA&O	2535	2535	2535	2535	2535
Timber	2038	2196	2207	2353	2336
Recreation	970	980	980	980	1024
TOTAL	5543	5711	5722	5868	5895
D					
FA&O	2593	2593	2593	2593	2593
Timber	2126	2543	3001	2947	2909
Recreation	789	800	818	835	844
TOTAL	5508	5936	6412	6375	6346
E					
FA&O	2236	2236	2236	2236	2236
Timber	3069	3531	3182	3371	3289
Recreation	642	700	717	717	717
TOTAL	5947	6467	6135	6324	6242

Administrative Facilities

All alternatives except E meet the Forest's needs that have been identified for administrative facilities. This includes ranger stations, administrative and work sites, fire lookouts, housing and storage facilities and their utility systems. New Fire, Administration, and Other (FA&O) construction is scheduled for the first three decades. After the third decade, a sustained program of replacing or upgrading the existing facilities to current standards on a fifty-year rotational cycle is implemented. Fifty years is the estimated useful life of a facility (structure)

constructed today and receiving routine maintenance. Alternative E does not provide sufficient funds for construction and reconstruction of facilities to prevent disinvestment or meet management needs for the level of planned resource activities. None of the alternatives cause significant natural resource damage as a result of administative facilities management. Tables 141 and 142 display the costs for implementing the facilities construction, reconstruction and maintenance programs for each alternative.

Table 141. Average FA&O Construction and Reconstruction Financing in M$ per Decade by Alternative

Planning Period	Alternatives PA	A	B	C	D	E
Planning Period 1	$3529	$3529	$3601	$3528	$3528	$2728
Planning Period 2	$1734	$1734	$1768	$1733	$1733	$1324
Planning Period 3	$1473	$1473	$1526	$1473	$1473	$1103
Planning Periods 4 through 20	$1672	$1673	$1693	$1672	$1672	$1353

Table 142. Average FA&C Maintenance Financing in M$ per Decade by Alternative

Planning Period	Alternatives PA	A	B	C	D	E
Planning Period 1	$875	$875	$919	$875	$875	$764
Planning Period 2	$1350	$1350	$1407	$1350	$1350	$1105
Planning Period 3	$1611	$1611	$1672	$1611	$1611	$1291
Planning Periods 4 through 20	$1673	$1673	$1766	$1672	$1673	$1341

Older buildings, which qualify for historic designation, are maintained for their historic value in all alternatives.

Energy Efficiency

Estimates of energy consumption by alternative include energy used to provide goods and services. Estimates are based on timber and fuelwood harvest, recreation use, grazing, road construction, reconstruction and maintenance, as well as fire management.

Alternative E is the most energy efficient alternative, considering the management goals. Alternative PA satisfies the planning problem and is slightly less energy efficient than Alternative E. Alternative D is the least efficient based on the expense of producing the high commodity outputs.

The other alternatives have higher estimated energy consumption needs because of higher activity levels with different combinations of net public benefits and higher costs to implement than the PA alternative.

Mitigation measures such as the use of energy efficient vehicles, trip consolidation and other conservative practices are considered in project level implementation of management activities, including timing and location for efficiency opportunities. Most of these practices covered apply to the implementation of any given alternative.

IRRETRIEVABLE COMMITMENTS

Irretrievable resource commitments result from allocation decisions that reduce production or use of renewable resources. Irretrievable commitments represent opportunities foregone for the period the Forest Plan is in effect and reflect trade-offs made to integrate multiple-use considerations or meet budget limitations. Irretrievable effects are summarized in Table 143.

Table 143. Average Annual Irretrievable Resource Commitments in the First Planning Period by Alternative

Resource	Alternatives PA	A	B	C	D	E
DEVELOPED RECREATION (MRVD's)						
Alt. Output	589.9	537.0	594.9	584.9	589.8	594.9
Irr. Comm.	5.0	57.9	0	10.0	5.1	0
DISPERSED RECREATION (MRVD's)						
Alt. Output	279.2	254.8	278.7	279.2	255.3	254.3
Irr. Comm.	0	24.4	0.5	0	23.9	24.9
WILDERNESS (MRVD's)						
Alt. Output	7.4	3.7	7.4	7.4	7.4	7.4
Irr. Comm.	0	3.7	0	0	0	0
WILDLIFE (MWFUD's)						
Alt. Output	181.0	175.0	174.0	190.0	175.0	180.0
Irr. Comm.	9.0	15.0	16.0	0	15.0	10.0
RANGE CAPACITY (MAUM's)						
Alt. Output	70.0	71.3	74.0	62.8	71.5	69.3
Irr. Comm.	4.0	2.7	0	11.2	2.5	4.7
TIMBER (MMCF)						
Alt. Output	145	121	145	131	137	195
Irr. Comm.	50	74	50	64	59	0
TOTAL PREFERRED FUELWOOD (MMBF)						
Alt. Output	88	52	98	75	89	51
Irr. Comm.	10	46	0	23	9	47
INCREMENTAL WATER YIELD (M ACRE-FT)						
Alt. Output	302.5	302.7	302.5	302.6	302.7	302.5
Irr. Comm.	0.2	0	0.2	0.1	0	0.2

ECONOMIC AND SOCIAL CONSIDERATIONS

Economic Efficiency Analysis

National Forest Management Act (NFMA) regulations [36 CFR 210.12] require extensive extensive analysis of economic efficiency in formulating, estimating effects, and evaluating alternatives. Present net value (PNV) was chosen as one measure of economic efficiency. PNV is the discounted benefits less the discounted costs. PNV measures the net economic benefits to the public for resources that have a market value or that were assigned value in the planning process.

PNV is calculated on the costs for labor and materials that implement the management direction of each alternative and on the revenue generated from the production of goods and services. Costs include the Forest budget plus protection cost, timber purchaser costs, and permittee costs.

Revenues include market prices for timber, range, developed recreation, and land uses. Assigned prices include prices for dispersed, wildlife, and wilderness recreation, and water. Revenues from mineral production are not included in FORPLAN since production is controlled by the private sector. Also, mineral revenues would be the same for each alternative and would not change the relative ranking of any alternative.

PNV is not a complete measure of economic efficiency because only the market or assigned prices or outputs for which prices can be estimated are counted as benefits while all costs are included. As a consequence, those alternitives with a relatively

greater focus on priced outputs tend to have greater PNV's. Differences in the quality of resource management that may accompany changes in levels of outputs are not reflected in the assumed prices.

Because not all costs and benefits can be priced, PNV is not the only index used to develop, compare, and evaluate alternatives. Alternatives were evaluated as to how well they maximized net public benefits. Net public benefits (NPB) is an overall expression of the value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather then a single measure or index. Alternatives having the highest PNV may not always provide the highest net public benefits when non-priced benefits and costs are considered. Chapter 2 provides more detail.

The Maximum PNV Assigned Value Benchmark is structured to provide the greatest monetary benefits for the costs incurred. This benchmark shows the most economically efficient combination of costs and benefits without specific regard for the protection of resources and the provision of integrated multiple-use management. The Maximum PNV Assigned Benchmark is not considered in detail, but instead was used for comparing PNV's of alternatives considered in detail, but instead was used for comparing PNV's of alternatives considered in detail. There are no constraints placed on the Maximum PNV Assigned Benchmark with the exception of fuelwood demand as a maximum for valuing fuelwood. Comparing the PNV's of the alternatives to the Maximum PNV Assigned Benchmark provides a measure of the financial trade-off or opportunity cost of an alternative.

PNV trade-offs and benefit/cost ratios between the alternatives are shown in detail in Chapter 2.

Employment and Income

Each alternative has a particular effect on employment, population, and total income patterns in the Forest's zone of influence. Differences are a function of the outputs produced in each alternative. Timber, sawmills, tourism, and wildlife recreation are important in the regional economy.

Computer input/output IMPLAN model was used to determine the effects of the alternatives for a variety of industry sectors. The input factors include:

Sawtimber	Timber Products
Fuelwood	Picnicking
Residential Skiing	Camping
Nonresidential skiing	Water Recreation
Snowmobiling	Dispersed Nonmotorized Recreation
Private Sector Concessions	Dispersed Motorized Recreation
Small Game Hunting	Big Game Hunting
Wildlife Non-consumption	Bird Hunting
Cattle Grazing	Fishing
Sheep Grazing	Governemnt Expenditures-O&M/Investment
Government Expenditures-Salary	

IMPLAN is based on data developed in 1977. Employment predictions are reasonably accurate since there has been no substantial change in technology in most sectors since 1977. Income figures are adjusted to 1982 dollar values to be compatible with other values in this document. The model projects only the opportunity for marginal change in employment and income.

A summary of the analysis of the IMPLAN model runs is displayed in Table 144. The 1977 base year column represents total employment and income existing in the impact area. Alternative A represents the impact area employment, income, and population attributed directly and indirectly to current Forest activities. The values identified for the other alternatives reflect changes from current management as a result of activities scheduled by the various alternatives.

Alternative B and E have greater impact than other alternatives. Alternative E maximizes generation of revenue and Alternative C tends to minimize expenditures. Sensitivity analysis reveals that the most sensitive industry sector in Coconino County is tourism trade, followed by lesser impact to the timber-sawmill sector.

The increase in jobs in the tourism and trade sector ranges from 91 in the non-commodity alternative to 500 in the RPA alternative. Job increases in timber-sawmilling sector from nineteen for the non-commodity alternative to 178 for Alternative E. Timber, tourism, restaurants, and recreation based business could

expect moderate employment increases with Alternative PA, but not to the extent generated by Alternatives B and E. Income changes are generally proportionate and associated with employment changes.

In summary, the significant impacts on employment in Coconino County would be due to employment associated with change in operation and expansion of developed recreation sites in the private sector and an increase in the timber program. The impact of any alternative on the lifestyle of residents outside of Coconino and Yavapai Counties would be negligible.

Table 144. Summary of Alternatives by Employment, Income, and Population in Decade 1

Sub-Areas	1977 Base Year	Alternatives A	PA	B	C	D	E
Coconino County							
Timber/Sawmills	600	260	51	50	19	32	178
Livestock	152	10	0	1	-2	0	0
Tourism & Trade	9351	698	113	500	91	302	453
Other	9204	107	52	141	47	92	141
Total Employment (jobs)	19307	1075	216	692	155	426	772
Income (1977 MM$)	363	16	4	10	3	6	12
Population	71000	3952	794	2545	568	1568	2840

Social Effects

For the county as a whole, the activities and scheduled outputs associated with the alternatives considered in detail would result in minor change in community stability. Communities that currently exhibit a rural or semi-rural atmosphere do not change as a result of Forest management direction proposed by any of the alternatives. Political and social organization would not be affected, and land use patterns would not change.

None of the proposed management alternatives is expected to result in any significant change in the present use of National Forest Lands or products by minorities. National Forest opportunities would continue to be equally available to all residents of the United States. With respect to employment, minorities and women are hired directly by the agency or obtain contracts from the agency or work for those who do. The level of hiring under the Equal Employment Opportunity (EEO) Program is directed by the agency and more contracts are issued. Budget reductions cause reductions in public and private sector employment. The alternatives ranked in order of decreasing expenditures in Planning Perion 1 are: E, PA, B, D, C, and A.

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Developed Recreation

Increased user conflicts, and deterioration and closure of some recreation sites occurs in Alternatives A and C since a portion of the developed recreation use is managed at less than standard service level.

Dispersed Recreation

Less than standard service management results in some deterioration of desirable settings and increased user conflicts under Alternatives A, D and E.

Soil and vegetation damage may occur in sensitive areas from unrestricted off-road vehicle use under Alternatives A and D.

Visual Resource	A gradual decline in visual diversity may occur in some sensitive areas under Alternative A.
Wilderness	Wilderness administration is inadequate and may degrade wilderness values under Alternative A.
Cultural Resources	All alternatives except Alternative A provide for increased levels of project activity in the woodland vegetative type with a corresponding risk of inadvertent cultural resource site damage.
Wildlife	Alternatives PA and C provide the highest level of diversity and interspersion of habitat. Alternatives B and D show a moderate increase in diversity of habitats and Alternatives A and E reflect a decline in diversity. Alternatives PA and C provide high levels of increased habitat quality. Alternatives B, D and E provide a moderate level of increased habitat quality while Alternative A results in a slight decline in habitat quality. Alternative PA provides the best distribution of diverse habitats and benefits the greatest number of management indicator species. Alternative C supplies a balance of habitats and increases habitat capability for indicator species using late seral stage pine and mixed conifer habitats. Alternatives PA and C result in the greatest increase in habitat capability for big game. Alternatives B and D provide moderate increases in habitat capability. Alternatives A and E result in declining habitat capability. All alternatives provide for conserving threatened and endangered species and special management of their habitats.
Riparian	Alternatives PA and C improve riparian areas to satisfactory condition by the second decade. Alternatives A, B and D improve a moderate amount of the riparian area to satisfactory condition by the second decade. Alternative E improves a low level of riparian improvement.
Range	Alternatives PA, A, B and D provide positive change in management intensity levels while Alternatives C and E reflect a decrease in intensity of management.
Timber	All alternatives illustrate compromises made in silviculture and timber management. Alternatives PA, B, C, and D allocate between 74 percent and ninety percent of the tentatively suitable acres to timber management. On these unsuitable coniferous acres, stand health and vigor declines and susceptibility to epidemic insect and disease outbreaks increases. Growth rates in the fifth decade vary from fifty percent of the LTSYC in Alternative B, to eighty percent in Alternative E. This analysis indicates that an irretrievable commitment of potential productivity is made under each alternative. Increased fire hazard from slash created following intermediate cutting is an unavoidable short-term adverse effect, for all alternatives. This adverse effect is mitigated through fuel treatment. A reduction in visual diversity results under Alternative A from timber harvest activities along road corridors that may be considered visually sensitive in the future from increased recreation use.
Watershed	All alternatives have a positive impact on watershed condition. However, only Alternatives PA, B, C and D improve all watersheds to satisfactory condition. Alternatives A and E provide for gradual improvement of watershed condition but do not improve all watersheds to satisfactory condition.
Lands	Alternatives A and E only allow infrequent field inspection of special land use permits which may eventually lead to long-term management problems.
Minerals	Important wildlife habitats may be lost or severely impacted during primary use seasons from both locatable and leaseable mineral activities under Alternatives B and D. Additional mineral withdrawals are recommended in all alternatives and may inhibit locatable mineral activities to some degree. Seasonal restrictions imposed on prospecting and exploration activities may increase mineral operating costs under all alternatives.

SUMMARY OF
SIGNIFICANT EFFECTS

Developed Recreation	All alternatives except Alternative A provide adequate developed recreation capacity to meet projected future use. Alternative A maintains a nearly even distribution between public and private sector developed recreation facilities. Alternatives PA and C maintain the even distribution of public and private sector facilities in the early planning periods, but gradually shift most of the facilities to the private sector in latter planning periods. Alternatives B, D and E result in a dramatic shift to private sector operations by converting existing public sector sites to concession operation. Developed recreation use is managed at the standard service level in Alternatives PA, B, D and E and enhance visitor experience, convenience and information. Alternatives A and C provide a portion of the developed recreation at less than standard service level which lowers the level of visitor experience, convenience and information. Some facilities may be temporarily closed and occasional over use may occur under less than standard service level management.
Dispersed Recreation	Alternatives PA, B and C manage the entire Forest at standard service level and enhance visitor experience, convenience and information services. Alternatives A, D and E provide less than standard service level management for portions of the Forest. All alternatives except Alternatives A and D provide for a 27 percent increase in acreage closed to off-road vehicles.
Visual Resources	Alternatives PA and B manage about one-third of the Forest under the high visual management intensity level and provide the greatest degree of visual diversity. Alternatives C and D manage most of the Forest under a moderate visual management intensity level. Under Alternatives PA, B, C and D, landscape diversity is enhanced in sensitive road corridors and adjacent to developed recreation sites. Alternative E manages about one-third of the Forest under the high visual management intensity level, and provides visual diversity slightly less than Alternative D. Alternative A provides the least visual diversity by managing the entire Forest under the low visual management intensity level.
Wilderness	All wilderness areas are managed at standard service level except for Alternative A. Alternative C provides for regular wilderness ranger patrols, elimination of non-conforming uses, and increased visitor contacts and provides the highest level of wilderness enhancement and protection. Alternatives PA, B, D and E focus management in high use areas and along wilderness boundaries to maintain and protect wilderness values.
Cultural Resources	Alternatives PA, B, C, D and E increase the area of cultural resource survey and focus surveys in woodland areas which currently receive little attention. The potential for inadvertent cultural resource site damage from project activities is greatest under Alternatives PA, B, C and E which have the highest level of project activity in woodland areas. Alternatives PA, B and C provide for cultural resource surveys in non-project areas and cultural resource site evaluations. Alternatives D and E also provide for limited non-project related survey and site evaluations.
Wildlife	Alternative A results in declining wildlife habitat diversity and habitat capability.
Timber	All alternatives provide adequate commercial sawtimber, products, and total fuelwood to meet projected future use. Alternative E best addresses the criteria for the resolution of the commercial timber issue. Alternative B best addresses the criteria for the resolution of the fuelwood issue. Alternative A provides the poorest resolution of both issues. All alternatives illustrate compromises made in silviculture and timber management, to better resolve other Forest resource issues, primarily wildlife habitat and range.

Lands	Budget allocations in Alternatives PA, B, C and D allow for an overall efficient lands management program. Alternatives PA, B, C, D and E almost double the amount of National Forest System lands available for exchange. The majority of this increase is adjacent to Williams, Tusayan and Parks.
Minerals	Mineral prospecting and exploration activities are restricted in Alternatives PA, C and E by seasonal closures in and adjacent to important wildlife habitats, and along visually sensitive roadside corridors. All alternatives recommend additional mineral withdrawals to protect capital investments, threatened and endangered species habitats and visually sensitive areas.
Air Quality	Transitory and localized effects occur in all alternatives because of smoke from wildfire and prescribed burning. The PA Alternative results in the most area burned, followed by Alternatives C, B, E, D and A in decreasing order of area burned.

5. List of Preparers

The following list the principal participants in development of the Kaibab National Forest "Land Management Plan", along with a brief description of their responsibilities. All personnel listed are members of the forest "ID" team, excepting the Forest Supervisor.

James R. (Rod) Anderson

B.S.F. University of the South,1977
M.F. Yale University, 1984
Peace Corps/Honduras: forest planner/manager; 2 years
Santa Fe NF: forester (planning); 2 years,
: forester (recreation); 1 year
Kaibab NF : forester (planning); 2 Years.

Responsible for data management and analysis, development and operation of FORPLAN model, and overall computer support.

Anthony F. Beke

B.S.E.T. Northern Arizona University, 1979
Kaibab NF: facilities engineer; 3 years
: transportation planner; 2 years

Responsible for transportation system and facliities analysis and input into planning process.

David G. Brewer

B.S. Resource Mgmt, University of Wisconsin at Stevens Point, 1976
Bureau of Indian Affairs: soil scientist; 1 1/2 years
Kaibab NF: soil scientist; 6 1/2 years
: range manager; 1/2 year

Responsible for edaphic and hydrologic data input and analysis.

Kenneth L. Byford

B.S. Wildlife Biology Kansas State University, 1971
Dept. of Health, Education, & Welfare: analyst; 6 years
Tonto NF: wildlife biologist; 3 1/2 years;
Kaibab NF: wildlife biologist; 2 1/2 years.

Responsible for adaptation of R-2 Wildlife Habitat Relationships model for Kaibab NF use; provided coefficients and data analysis.

Thomas F. Gillett

B.S. Forest Management Northern Arizona University, 1976
Coconino NF: forest technician (fire); 1 year
: forester (timber); 2 years
Kaibab NF: forestry technician (timber); 1/2 year
: forester (recreation, lands, and minerals); 7 years

Responsible for development of Recreation model; supplied recreation, visual management, cultural resource, land uses and minerals data and analysis for the planning process.

Philip K. Hunkins

B.S. University of Minnesota, 1962
Peace Corps/Brazil: forest research & education; 2 years
Superior NF: forester (timber mgmt); 1 year
Green Mountain NF: forester (recreation & lands); 4 years
Carribean NF: forester (recreation & lands); 4 years
George Washington NF: forester (recreation & lands); 3 years
Kaibab NF: forester (land management planning); 1 year
: land management planner; 7 1/2 years

Planning team leader; provided overall direction for formulation and development of FORPLAN model, analysis and plan.

Leonard A. Lindquist	B.S. Forest Management Iowa State University, 1956 Cibola, Sitgreaves, Coronado & Santa Fe NF's: forester (various); 4 years Tonto NF: District Ranger; 5 years Sitgreaves NF: Forester (timber); 4 years Caribbean NF: Forest Supervisor; 3 years Kaibab NF: Forest Supervisor; 10 years Forest Supervisor, responsible official for development of LMP, provided overall support and direction for the planning team.
Gary D. Loving	B.S. Forest Management Northern Arizona University, 1973 Lincoln NF: forestry technician (fire); 5 years Coconino NF: forestry technician (fire); 4 years : forester (timber); 1 year Kaibab NF: forester (recreation & lands); 3 years : forester (fire); 8 years Provided fire management data and analysis for the process.
Donald H. Richard	B.S. Forest Management Northern Arizona University, 1963 Gila NF: forester (asst ranger); 2 years Coconino NF: forester (fire, recreation, lands); 3 years Coronado NF: forester (range, wildlife, watershed); 6 years Cibola NF: forester (range, wildlife, watershed); 3 years Kaibab NF: forester (range); 9 years Provided Range resource data and analysis for the process.
David Wahlfeld	B.S. Botany Colorado College, 1964 M.S. Forestry University of Montana 1966 Francis Marion NF: forester (timber); 3 years Tombigbee/Holly Springs NF: forester (other resources); 2 years Kaibab NF: forester (timber); 11 years Developed initial silvicultural input through use of the ECOSIM Stand simulation model.
Steven M. Walker	B.S. Forestry Northern Arizona University, 1977 Prescott NF: forestry technician (fire); 3 years Consultant (New Mexico): forester; 2 years Wasatch-Cache NF: forester (timber); 5 years Kaibab NF: forester (timber); 2 years Provided key support for the timber resource, development and analysis of the FORPLAN model.
Calvin Wettstein	B.S. Forestry Rutgers University, 1973 M.S. Northern Arizona University, 1977 Kaibab NF: forester (timber); 2 years : forester (recreation); 2 1/2 years : forester (planning); 3 years R-10;RO: forester (planning); 1 1/2 years. Data analyst and manager prior to transfer to R-10 office.

6. Consultation With Others

Copies of the Kaibab National Forest Land and Resource Management Plan and Draft Environmental Impact Statement are distributed to the following Federal and State agencies, elected officials, local governing bodies, Native American organizations, libraries and businesses. Hundreds of interested individuals receive the documents, too numerous to mention here. The complete list is available in the Forest Supervisor's Office. In many cases, the listed organizations may receive copies for review at various levels in the organization.

Federal Level Organizations

Apache-Sitgreaves National Forests
BLM; Minerals Division
Bureau of Indian Affairs
Bureau of Land Management
Carson National Forest
Cibola National Forest
Coconino National Forest
Coronado National Forest
Department of Agriculture
Department of Interior Program Policy
Department of the Army
Dixie National Forest
Environmental Impact Division Office of Environmental Protection
Environmental Protection Agency
Environmental Protection Agency Office of Federal Activity
Federal Aviation Administration
Gila National Forest
Grand Canyon National Park
Honorable Barry Goldwater
Honorable Bob Stump
Honorable Dennis DeConcini
Honorable John McCain
Honorable Morris K. Udall
Lincoln National Forest
NPS/ACISA Crim. Intel.
Office of Environmental Affairs; Dept of Commerce
Prescott National Forest
Santa Fe National Forest
Tonto National Forest
USDA Soil Conservation Service
USDA: Forest Service Rocky Mountain Station
USDC Small Business Administration
USDC Weather Bureau

State Level Organizations

Arizona Department of Mineral Resources
Arizona Department of Public Safety
Arizona Department of Transportation
Arizona Department of Water Resources
Arizona Division of National Resource Management
Arizona Game & Fish
Arizona Game & Fish Commissioner
Arizona Office of EP&D
Governor's Commission on the Arizona Environment
Arizona State Clearinghouse
Arizona State Forestry Div.
Arizona State Land Department
Arizona State Parks
Honorable John Hayes
Honorable John Wettaw
Honorable Sam McConnell, Jr.
Honorable Tony Gabaldon

Native American Organizations

Ak-Chin Community Council
BIA Forestry Department
Cocopah Tribal Council
Colorado River Indian Tribes
Colorado River Tribal Council
Dilcon Navajo Chapter
Director's Office of Native Healing Service
Gila River Community Council
Havasupai Community Action Program
Havasupai Tribal Council
Hopi Tribal Council
Hualapai Tribal Council
Indian Development District of Arizona
Kaibab Tribal Council
Kingichee Chapter
Native Americans for Community Action
Navajo Forest Products
Navajo Forestry Department
Navajo Tribal Recreation Resource Department
Office of Navajo Economic Opportunity
Papago Tribal Council
Pueblo of Zuni
Quechan Tribal Council
Salt River Pima Indian Community
San Carlos Council
White Mountain Apache Tribal Council
Yavapai Tonto Apache

Local Government Organizations

Coconino County Board of Supervisors
Coconino County Highway Department
Coconino County Manpower
Coconino County Sheriff
Cooporative Extention Service, Pinal Co. 4-H
Kanab Town Council
Northern Arizona Council of Governments
Pima Council on Aging
Williams City Council
Williams Mayor James Hoffman

Libraries

Arizona State University Library
Cottonwood Town Government Library
Flagstaff City- Coconino County Public Library
Fredonia Public Library
Grand Canyon Public Library
Kanab Public Library
Northern Arizona University Library
Page Public Library
University of Minnesota
Williams Public Library

Private Organizations

AC Bud Davis-Pac Board Products
Allied Forest Industries
American Motorcyclist Association
Amoco Production Company
Anaconda Mining
Applied & Environmental Science
Arco Communications Inc.
Arizona Bowhunters
Arizona Cattle Growers
Arizona Cooperative Wildlife Research Unit
Arizona Daily Star
Arizona Daily Sun
Arizona Desert Racing Association
Arizona Environmental Consultants
Arizona Mining Association
Arizona Oil & Gas Conservation Commission
Arizona Public Service Company
Arizona Republic
Arizona State University
Arizona Wildlife Federation
Arizona Wildlife Federation
Asarco Inc.
Atchison, Topeka & Santa Fe Rail Road
Atlantic Richfield Company
Audubon Society
Binner Nash Ranch
Black Mesa Pipeline Inc.
Bullhead City Lions Club
CON Service Corporation
Carolina Sales, Inc.
Cataract Livestock Company
Center for Environmental Studies
Chamber of Commerce, Fredonia
Chamber of Commerce, Grand Canyon
Chamber of Commerce, Williams
Chamber of Commerce, Kanab
Circle Pines Camperland Inc.
Citizens for the Protection of the Prescott Area
Cocapai Res. & Cons. Dev. Comm.
Coconino Cattle Grower's Association
Coconino Sportsmen
College of Agriculture NM State University
College of Agriculture-Dept. of Forest Science
College of Natural Resources
Colorado State University
Cornelius Realty Services, Inc
Crossed J Ranch
Defenders of Wildlife
Department of Ecology & Evol Biology
Department of Plant Pathology
Dial Manufacturing
Duke City Lumber Company
El Paso Natural Gas Company
Elliott's Cleaning Service
Embry Riddle University
Energy Fuels Nuclear Inc.
Escalante Sawmills, Inc.
Evergreen Lumber Company Inc.
Fin & Feathers
Forest Contractor's Weekly
Forest Mgmt Study Group, Yale Univ.
Forest Planning
Four Corners Wilderness Workshop
Fred Harvey Inc.
Friendly Pines Camp
Garkane Power Association
Garkane Power Association Inc.
Gill Associates
Globe Development
Gold Fields Mining
Grand Canyon Airlines, Inc.
Grasslands West Company
Green & Gold Forestry Corporation
Green Peace Forest Enterprise
Grinnell National History Society
H & H Seed Company, Inc.
Harold I. Bowman & Sons
Honeymoon Trail Company
Indian Arizona News
Interaction Systems
International Recreation, Inc.
J. E. Fleming & Associates
Jacob Lake RV & Trailer Camp
Kaibab Industries, Inc.
Keith Bunker Inc.
Lake Powell Chronicle
Landman Amselco Co.
Lassen Community College
Lockett Springs Ranch, Inc.
Mesa Four-Wheelers
Maricopa Audubon Society
Minerals Exploration Coalition
Moqui Lodge
Mora Research Center
Motorola, Inc.- Attn: Site Department
Mountain States Tel-Dist Service
Museum of Northern Arizona
NAU, Department of Humanities

National Forests Products Association
National Off-Road Bicycle Association
Nature Conservancy
Nerco Mining Company
Newmont Explo Ltd.
Niles Radio Corporation
Odds & Ends Lumber
Pathfinder Mines
Paul F. Miller Contracting
Prescott College
Prescott Courier
Rocky Mtn. Elk Foundation, Arizona Chapter
Salt River Project
Santa Fe Mining Inc.
School of Forestry, Dean; NAU
School of Renewable Natural Resources; U of A
Sierra Club
Sierra Club, Southwest Office
Society of American Foresters
Society of Range Management
Southern Utah Wilderness Alliance
Southwest Forest Industries
Squire Motor Inn
State Pesticide Coordinator
State University of New York
Stephens Landleveling, LTD.
Sun City Trail Riders
Sun Valley Church
T&T Dynamite Landscaping
Tesoro Petr. Corporation
Texas Eastern Transmission Corporation
Texasgulf Minerals
The Wilderness Society
Tierra Madre Consultants
Transwestern Pipeline Company
Turtle Mountain Manufacturing Company
Twitty, Sievwright & Mills
U.S. Borax
Union Oil of California
United 4wd Association
University of Minnesota-Forestry Lib
University of Wyoming
Utah International
Vermillion Cliffs Cattle Company
Western Forest Industries Association
Western Pine Lumber Company
Western Regional Council
Yuma Audubon Society

Glossary

ACRE-EQUIVALENT - A unit of habitat output related to fish or wildlife habitat improvement projects. Acre equivalents are based on the acres of habitat that are influenced by an acre of habitat actually modified by the project. For example, an acre of winter range burned is credited with influencing five acres of summer range.

ACRE-FOOT - A water volume measurement equal to the amount of water that would cover one acre to a depth of one foot (43,560 cubic feet or 325,851 gallons).

ACTIVITY FUELS - Logging debris generated from any activity on the Forest such as fuelwood gathering, precommercial thinning, timber harvesting, and road construction, which increases fire potential.

ADMINISTRATIVE SITE - A site which primarily exists for general administrative purposes. It normally will include office, warehouse, outside storage, and parking areas. It may include housing and pasture for livestock. A work center may be part of an administrative headquarters site.

AFFECTED ENVIRONMENT - The biological, physical, social, and economic environment subject to changes that will or may take place, as a result of proposed human activity.

AGE CLASS - Interval of years, commonly twenty, into which trees are grouped for management. Example: 1 to 20 years, 21 to 40 years.

ALIENATED MINERAL RIGHTS - Ownership of the mineral rights is by someone other than the surface rights owner.

ALLOCATION - The assignment of management prescriptions to particular land areas to achieve the goals and objectives of an alternative.

ALLOWABLE SALE QUANTITY (ASQ) - The quantity of timber that may be sold from the area of land covered by the Forest Plan for a time period specified by the plan. The quantity is usually expressed on an annual basis as the average annual allowable sale quantity.

ALTERNATIVE - A proposition or situation offering a choice between two or more management methods, only one of which may be chosen.

AMENITY - The pleasurable, educational, or aesthetic features of the land or resources.

ANALYSIS AREA - One or more sites combined for the purpose of analysis in formulating alternatives and estimating various impacts and effects.

ANALYSIS OF MANAGEMENT SITUATION (AMS) - A determination of the ability of the planning area to supply goods and services in response to society's demand for those goods and services.

ANIMAL MONTH (AM) - One animal grazing for one month.

ANIMAL UNIT MONTH (AUM) - The quantity of forage required by one mature cow (1,000 pounds) or the equivalent for one month.

AQUATIC - Pertaining to standing and running water in streams, rivers, lakes, and reservoirs.

ARTERIAL ROADS - Roads that provide service to large land areas and usually connect with public highways or other Forest arterial roads to form an integrated network of primary travel for maximum mobility and travel efficiency, rather than specific resource-management service. They are usually developed and operated for long-term land and resource management purposes and constant service.

ARTIFACT - An object that has been modified, used, or constructed by man. Stone tools, pottery, buildings, roads, and mines are examples of artifacts.

ASSESSMENT - The Renewable Resource Assessment required by the Resources Planning Act (RPA).

AUM - See "Animal Unit Month."

AVAILABLE FOREST LAND - Land which has not been legislatively withdrawn by Congress or administratively withdrawn by the Secretary of Agriculture or Forest Service Chief from timber production.

B/C VALUES - See "Benefit/Cost Ratio."

BACKGROUND [VISUAL DISTANCE ZONE] - The distant part of a landscape; surroundings, especially those behind something, and providing harmony and contrast; area located from three to five miles to infinity from the viewer.

BASAL AREA - Measurement of how much of a site is occupied by trees. It is determined by measuring the square feet of the cross-section of all the trees per acre at breast height [4.5 feet].

BASE TIMBER HARVEST SCHEDULE - The timber harvest schedule in which the planned sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade of the planning period, and this planned sale and harvest for any decade is not greater than long-term sustained yield capacity. [36 CFR 219.3[c] NFMA Regulations]

BENCHMARK - A category of Forest Planning alternatives used to establish standards by which to compare alternatives considered in detail. Benchmark alternatives include minimum level, minimum acceptable level, maximum resource levels, and maximum present net value levels.

BENEFIT/COST RATIO - The total discounted benefits of any activity divided by the total discounted costs.

BIG GAME - The larger species of wild animals that are hunted, such as elk, deer, bighorn sheep.

BIOLOGICAL POTENTIAL - The maximum production of a selected organism that can be attained under optimum management.

BLM - Bureau of Land Management.

BOARD FOOT - Measure of an amount of timber equivalent to a piece 12" x 12" x 1". The boards bought at a lumber store are somewhat smaller because they have been planed smooth.

BOARD FOOT/CUBIC FOOT CONVERSION RATIO - Both board foot and cubic foot volumes can be determined for timber stands. The number of board feet per cubic foot of volume varies with tree species, diameter, height, and form factors.

BROWSE - Twigs, leaves, and young shoots of trees and shrubs on which animals feed; in particular, those shrubs which are utilized by big game animals or domestic livestock for food.

BUFFER-FILTER STRIP - A designated land or water area, along the perimeter of some land use, where activities are regulated so as to prevent unwanted effects into areas beyond the buffer.

CABLE LOGGING - A method for transporting logs from stumps to collecting points which utilizes a cable system as the main device for moving them.

CANOPY - The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

CAPABILTIY - The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as silviculture or protection from fires, insects, and disease.

CAPABILITY AREA - An area of land delineated for the purpose of estimating responses to various management practices, resource values, output coefficients, and multi-resource or joint production functions. Capability areas may be synonymous with ecological land units, ecosystems, or land response units. Capability areas are the single geographic delineations used to describe characteristics of the land and resources in integrated forest planning.

CAPABLE FOREST LAND - Land with a biological growth potential which is equal to or exceeds the minimum standard for timber production [an average annual growth rate of at least twenty cu. ft. per acre].

CAPABLE RANGE - Land that can produce forage for animal consumption without impairing other forage values; generally considered as land that is not being cultivated.

CARRYING CAPACITY - The optimum density of a species which a given environment or range is capable of sustaining, without deteriorating that environment or range.

CAVITY - The hollow excavated in trees by birds or other natural phenomena; used for roosting and reproduction by many birds and mammals.

CEQ - Council on Environmental Quality.

CFR - Code of Federal Regulations.

CHEMICAL WATER QUALITY - Measurements of chemical parameters (alkalinity, dissolved oxygen, dissolved iron, etc.) used to describe the quality of water.

CLEARCUTTING - Harvesting of all trees in one cut on an area for the purpose of creating a new, even-aged stand. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as a separate age class in planning. Regeneration is obtained through natural seeding, or through planting or direct seeding.

CULMINATION OF MEAN ANNUAL INCREMENT (CMAI) - Point in the age of a forest stand in which the mean annual growth increment no longer increases.

COLLECTOR ROADS - Roads that serve smaller land areas and are usually connected to Forest arterial roads or public highways. They collect traffic from local roads and terminal facilities. Collector roads are operated for constant use.

COMMERCIAL FOREST LAND (CFL) - Forest land which is producing or capable of producing crops of industrial wood and which has not been reserved or deferred from entry. This includes areas suitable for management to grow crops of industrial wood generally of a site quality capable of producing in excess of twenty cubic feet per acre of annual growth. This includes both accessible and inaccessible areas. Permanently inoperable or nonstockable areas are excluded because they are not suitable for silvicultural management. Conversely, nonstocked areas which could be stocked and otherwise meet this definition are included.

COMMERCIAL THINNING - Cutting for the sale of products (poles, posts, pulpwood, etc.) in immature stands to improve the quality and growth of the remaining stand.

COMMODITY OUTPUTS - A resource output with commercial value; all resource products which are articles of commerce.

COMMON VARIETY MINERALS - See minerals, common variety.

COMMUNITY LIFESTYLES - The ways in which residents conduct their everyday routines and how the "way they live" is associated with National Forest.

CONCERN - See management concern.

CONCESSION PERMIT - A permit which authorizes private individuals or corporations to operate a facility on National Forest Land as a commercial profit-making venture.

CONDEMNATION - In real property law, the process by which property of a private owner is taken for public use, without his consent, but requiring payment of just compensation.

CONIFER - A group of cone-bearing trees, mostly evergreen, such as the pine, spruce, fir, pinyon, juniper, etc.

CONSTRAINED MAXIMUM LEVEL BENCHMARK - The highest level of a particular output that could be produced over time, subject to the production of minimum acceptable levels for all other outputs.

CONSTRAINT - A quantification of the minimum or maximum amount of an output or cost that could be produced or incurred in a given time period.

CONSUMPTIVE USE - Those uses of a resource that reduce the supply. For example, some consumptive uses of water are: irrigation, domestic, and industrial use.

CORD - A unit of gross volume measurement for stacked round or split wood. A standard cord is 4' x 4' x 8' or 128 cubic feet. A standard cord may contain sixty to one hundred cubic feet of solid wood depending on the size of the pieces and the compactness of the stack.

CORRIDOR - A linear strip of land which has ecological, technical, economic, social, or similar advantages over other areas for the present or future location of transportation or utility routes.

COST COEFFICIENTS - Values which relate an acre of land to a particular dollar cost in a specific period of time.

COST EFFICIENCY - A comparative measure of economic efficiency determined by maximizing the present net value of an alternative, subject to meeting the objectives of the alternative.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies and advises the President on environmental matters.

COVER/FORAGE RATIO - The ratio of cover (usually conifer types) to foraging areas (natural openings, clearcuts, etc.).

CRITICAL HABITAT - That portion of a wild animal's habitat that is critical for the continued survival of the species. Under Endangered Species Act, specific area designated for that species that is essential to survival of the species and which may require special management or protection.

CULTURAL RESOURCE - The physical remains of past human cultural systems and places or sites of importance in human history or prehistory.

DBH - Diameter at breast height. Diameter of a tree approximately 4 1/2 feet above the ground.

DEMAND TRENDS - The expected future need or desire for outputs, services, and uses.

DEPARTURE - A timber harvest schedule which deviates from the principle of nondeclining flow by exhibiting a planned decrease in the timber sale and harvest schedule at any time in the future. A departure can be characterized as a temporary increase, usually in the beginning decade(s) of the planning period, over the base sale schedule that would otherwise be established, without impairing the future attainment of the Forest's long-term sustained yield capacity.

DEVELOPED RECREATION - Recreation that requires facilities that result in concentrated use of an area. Examples are campgrounds and ski areas. Facilities might include: Roads, parking lots, picnic tables, toilets, drinking water, ski lifts, and buildings.

DIRECTIONAL DRILLING - The art of drilling a borehole wherein the course of the hole is planned before drilling. Such holes are usually drilled with rotary equipment at an angle to the vertical, and are useful in avoiding obstacles or reaching side areas.

DISPERSED RECREATION - Outdoor recreation which occurs on areas which are not developed for intensive recreation use. Dispersed areas include general undeveloped areas, roads, trails, and water areas not treated as developed sites.

DIVERSITY - The relative degree of abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area.

EA - Environmental Assessment.

EARLY FOREST SUCCESSION - The biotic community that develops immediately following the removal or destruction of the vegetation in an area.

ECONOMIC EFFICIENCY ANALYSIS - A comparison of the values of resource inputs (cost) required for a possible course of action with the values of resource outputs (benefits) resulting from such action. In this analysis, incremental market and non-market benefits are compared with investment and physical resource inputs.

ECONOMICS - The study of how resources, goods, and services are allocated among competing uses.

ECOSYSTEM - The system formed by the interaction of a group of organisms and their environment.

EDGE - The place where different plant communities , successional stages or vegetative conditions border upn each other.

EFFECTS - Results expected to be achieved relating to the physical, biological, and social (cultural and economic) factors resulting from a land use or activity. Examples of effects are tons of sediment, pounds of forage, person-years or employment, income, etc. There are direct effects, indirect effects, and cumulative effects.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range.

ENDEMIC - Native or confined to a certain region; having a comparitively restricted distribution.

ENVIRONMENTAL ANALYSIS - An analysis of alternative actions and their predictable short- and long-term environmental effects which include physical, biological, economic, social, and environmental design factors and their interactions.

ENVIRONMENTAL ASSESSMENT - The concise public document required by the regulations for implementing the procedural requirements of NEPA (40 CFR 1508.9).

ENVIRONMENTAL IMPACT STATEMENT (EIS) - The version of the statement of Environmental Effects required for major Federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document which must follow the requirements of NEPA, the Council on environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal.

EROSION - The wearing away of the land's surface by running water, wind, ice, or other geological agents. It includes detachment and movement of soil or rock fragments by water, wind, ice, or gravity.

EVAPOTRANSPIRATION - The conversion of water, whether open, as soil moisture, or within plants, into water vapor that is released into the atmosphere.

EVEN-AGED SILVICULTURE - The combination of actions that results in the creation of stands in which trees of essentially the same age grow together. Managed even-aged forests are characterized by a distribution of stands of varying ages (and therefore tree sizes) throughout the forest area. Regeneration in a particular stand is obtained during a short period at or near the time that the stand has reached the desired age or size and is harvested. Clearcutting, shelterwood cutting, seed tree cutting, and their many variations are the cutting methods used to harvest the existing stand and regenerate a new one. In even-aged stands, thinnings, weedings, cleanings, and other cultural treatments between regeneration cuts are often beneficial. Cutting is normally regulated by scheduling the area of harvest cutting to provide for a forest that contains stands having a planned distribution of age classes. (36 CFR 211.3[k] NFMA Regulations.)

EVEN-FLOW - Maintaining a relatively constant output of timber from decade to decade.

EXPERIENCE LEVELS - The range of opportunities for satisfying basic recreation needs of people. A scale of five experience levels ranging from "primitive" to "modern" is defined for the National Forest System.

EXTENSIVE GRAZING - Season-long use of rangelands, with distribution of livestock occurring through riding, salting, etc., instead of pasture rotation.

EYRIE - The nesting site of a bird of prey, as an eagle or a hawk.

FACILITY CONDITION CLASS - The rating system used in the Recreation Information Management system to classify the condition and maintenance needs of recreation sites and areas.

FAUNA - The animals of a given region or period.

FEE SITE - A Forest Service recreation area in which users must pay a fee. Fee sites must meet certain standards and provide certain facilities as specified in the Forest Service Manual.

FINAL CUT - Removal of the last seed bearers or shelter trees after regeneration is considered to be established under a shelterwood system.

FIRE HAZARD - The fuel in which a fire will ignite and burn.

FIRE MANAGEMENT AREA - One or more parcels of land with clearly defined boundaries and with established fire management direction which is responsive to land and resource management goals and objectives.

FIRE MANAGEMENT/EFFECTIVENESS INDEX (FMEI) - The index value measures effectiveness of annual fire management operational programs. It is a planning, attainment, analysis, and evaluation tool for both annual and long-term programs. Measured in dollars per thousand acres protected, the objective is to minimize the index value.

FIRE RISK - The probability of a fire starting from natural or man-made causes.

FISHERIES HABITAT - Streams, lakes, and reservoirs that contain and support fish.

FLOOD PLAIN - Land adjacent to a channel which is covered with water when the stream overflows its banks.

FLOODPLAIN - Low land and relatively flat areas joining inland and coastal waters, including debris cones and flood prone areas of offshore islands. The minimum area included is that subject to a one percent (100-year recurrence) or greater change of flooding in any given year.

FLORA - The plants of a given region or period.

FORAGE - All nonwoody plants (grass, grass-like plants and forbs) and portions of woody plants (browse) available to domestic livestock and wildlife for food. Only a portion of a plant is available for forage if the plant is to remain healthy.

FORAGE AND HERBAGE - Forage refers specifically to all browse and nonwoody plants that are available to livestock or game animals and used for grazing or harvested for feeding. Herbage may also include material not acceptable to grazing or browsing animals.

FORAGE UTILIZATION - (1) The portion of current year's forage production by weight that is consumed or destroyed by grazing animals. Syn., degree of use. Expressed in percent of current year's growth utilized by grazing animals on an average over time based on a system of range management that will maintain the key forage species while achieving other management objectives such as the maintenance of watersheds, wildlife habitat, and recreational values and the protection of regenerating plants. (2) The percent expressed in the "Prescriptions for Management Areas" is the estimated average forage utilization allowable to meet the objectives of that prescription under sustained-yield management.

FORB - Any herbaceous plant other than grass or grass-like plants.

FOREGROUND (VISUAL DISTANCE ZONE) - The part of a scene, landscape, etc., which is nearest to the viewer, and in which detail is evident, usually one-half to one-quarter mile from the viewer.

FOREST AND RANGELAND RENEWABLE RESOURCES PLANNING ACT OF 1974 - A Act of Congress requiring the preparation of a program for the management of the National Forests' renewable resources, and of land and resource management plans for units of the National Forest System. It also requires a continuing inventory of all National System lands and renewable resources.

FOREST LAND - Land at least ten percent stocked by forest trees of any size, or formerly having had such tree cover, and not currrently developed for nonforest use.

(FOREST LAND) CAPABLE - Forest land which is capable of growing industrial crops of wood at or above the minimum biological growth established by the Regional plan. The classification includes both accessible and inaccessible, stocked and non-stocked land.

(FOREST LAND) CAPABLE AND AVAILABLE - Capable forest land which has not been legislatively withdrawn or administratively withdrawn from timber production by the Secretary or the Chief of the Forest Service.

(FOREST LAND) CAPABLE BUT NOT AVAILABLE - Capable forest land which has been legislatively withdrawn or administratively withdrawn from timber production by the Secretary or Chief of the Forest Service. Capable but not available forest land is classed as not suited for timber production.

(FOREST LAND) CAPABLE-RESERVED - Capable forest land which has been legislatively withdrawn or administratively withdrawn from timber production on a permanent basis. Examples of this classification are: Wilderness Areas, Primitive Areas, Research Natural Areas, or special interest areas, or similar formal withdrawals approved by the Chief or higher authority.

(FOREST LAND) NOT CAPABLE - Forest land which is not capable of growing industrial crops of wood at least at the minimum biological growth potential of twenty cubic feet per acre annually as established in the Regional plan. Forest land not capable is classed as land not suited for timber production.

FOREST PLAN - A process, required by Law, for assessing economic, social, and environmental impacts, which describes how land and resources will provide for multiple use and sustained yield of goods and services.

FOREST SUPERVISOR - The official responsible for administering the National Forest System lands in a Forest Service Administrative unit, which may consist of one or more National Forests or all the Forests within a State. This person reports to the Regional Forester.

FOREST SYSTEM ROAD - Roads that are part of the Forest development transportation system, which includes all existing and planned roads, as development transportation facilities.

FOREST-WIDE STANDARD - A principle requiring a specific level of attainment, a rule to measure against. The Forest-wide standard applies to all areas of the Forest regardless of the other prescriptions applied.

FORPLAN - A linear programming model used for developing and analyzing Forest planning alternatives.

FSH - Forest Service Handbook.

FSM - Forest Service Manual.

FUEL BREAK - A zone in which fuel quantity has been reduced or altered to provide a position for suppression forces to make a stand against wildfire. Fuel breaks are designated or constructed before the outbreak of a fire. Fuel breaks may consist of one or a combination of the following: natural barriers, constructed fuelbreaks, man-made barriers.

FUEL MODEL - A simulated fuel complex for which all the fuel descriptions required by the mathematical fire spread model have been specified.

FUELS - Materials, including both living plants and dead, woody, vegetative materials, which are capable of burning.

FUELS MANAGEMENT - Manipulation or reduction of fuels to meet Forest protection and management objectives while preserving and enhancing environmental quality.

FUELWOOD - Wood that is round, split or sawed, and cut into short lengths for burning. Also known as firewood.

FULL SERVICE MANAGEMENT - Management of developed recreation facilities to provide optimum maintenance and enchance visitor experience.

GAME SPECIES - Any species of wildlife or fish for which seasons and bag limits have been prescribed, and which are normally harvested by hunters, trappers, and fishermen under State or Federal laws, codes, and regulations.

GAUGING STATIONS - Continuous streamflow measuring station.

GOAL - A concise statement of the state or condition that a land and resource management plan is designed to achieve. A goal is usually not quantifiable and may not have a specific date for completion. [36 CFR 219.2[1]]

GOODS AND SERVICES - The various outputs produced by forest and range land renewable resources, the tangible and intangible values of which are expressed in market and nonmarket terms.

GRAZING CAPACITY - The maximum level at which animals can graze an area without damage to the vegetation or related resources.

GRAZING PERMITTEE - An individual who has been granted written permission to graze livestock for a specific period on a range allotment.

GROUNDWATER - Subsurface water in a saturated zone or geologic stratum.

GROUP SELECTION CUTTING - Involves the removal of small groups of trees to meet a predetermined goal of age distribution and species in the remaining stand. The distance across an opening created by removal of a group of trees is usually no more than one to two mature tree heights.

GROWING STOCK LEVEL (GSL) - Expressed in either stems per acre or square feet of basal area of timber growing on any area.

GUIDELINE - an indication or outline of policy or conduct.

HABITAT - The place where animals live. It can be water for beaver, fish, and aquatic insects; rocks for pika, bats, and some species of birds; or forested areas for many mammals, birds; or forested areas for many mammals, birds, and reptiles.

HABITAT CAPABILITY - see Carrying Capacity.

HABITAT TYPE - An aggregation of all land areas potentially capable of producing similar plant communities at climax.

HARDWOOD - A conventional term for the timber of broad-leaved trees, and the trees themselves, belonging to the botanical group, Angiospermae.

HARVEST CUT - The removal of a stand of trees as a final cut in even-aged management, or the removal of mature trees in uneven-aged management. Regeneration encouragement is emphasized.

HERBICIDE - A chemical compound used to kill or control growth of undesirable plant species.

HERBIVORE - An animal that feeds on plant substances.

HIDING COVER - Plants or other objects used by wildlife for concealment. Adequate big-game cover is defined as vegetation capable of hiding ninety percent of a standing elk from a viewer at a distance of 200 feet or less.

HORIZONTAL STRUCTURE - The arrangement of single age and size classes by stands. Stands representing different age and size classes should be distributed within a forested area.

HYDROLOGIC FUNCTION - The ability of a watershed to sustain favorable conditions of streamflow. Favorable conditions of streamflow are measured in terms of water quality, quantity and timing.

IMPLEMENTING REGULATIONS - Regulations generated by an agency to implement an Act of Congress, i.e., 36 CFR 219 contains implementing regulations for RPA and NFMA.

IMPROVEMENT - Man-made developments such as roads, trails, fences, stock tanks, pipelines, power and telephone lines, survey monuments, and ditches.

IN-HOLDINGS - Lands within the proclaimed boundaries of a National Forest that are owned by some other agency, organization, or individual.

INDICATOR SPECIES - A wildlife species whose presence in a certain location or situation at a given population level indicates a particular environmental condition. Population changes are believed to indicate effects of management activities on a number of other wildlife species.

INDIGENOUS SPECIES - Species historically native to an area; not introduced by man.

INSECTICIDE - An agent used to control insect populations.

INSTREAM FLOW - That streamflow necessary to meet seasonal streamflow requirements for maintaining aquatic ecosystems, visual quality, and recreational opportunities on National Forest lands at acceptable levels.

INTEGRATED PEST MANAGEMENT - A management strategy for suppression of forest pests which integrates silvicultural mechanical, biological, and chemical suppression strategies which achieve greater efficiency and safety than the same strategies used alone.

INTENSIVE GRAZING - Grazing management that controls distribution of cattle and duration of use on the range, usually by fences, so parts of the range are rested during the growing season. See Livestock Grazing Management Level D.

INTERDISCIPLINARY TEAM [ID Team]] - A group of individuals with differing complementary skills. An interdisciplinary team is assembled because no single scientific discipline is sufficient to adequately identify and resolve issues and problems. Team member's interaction provides necessary insight to all stages of the process.

INTERMEDIATE CUTTING - Any removal of trees from a stand between the time of its formation and the regeneration cut. Most commonly applied intermediate cuttings are release, thinning, improvement, and salvage.

INTERMITTENT STREAM - A stream which flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow in mountainous areas.

INTERPRETIVE SITES - A developed site at which a broad range of natural or cultural history is interpreted or described for the enjoyment of the public.

INTOLERANT SPECIES - Those plant species that do not grow well in shade.

INVERSION - A stable layer of air where the temperature of the air increases with height.

ISSUE - A subject or question of widespread public discussion or interest regarding management of National Forest System Lands.

KEY AREA - In grazing, that portion of a pasture or grazing unit, which because of its nature, serves to control the pattern of grazing use for the pasture as a whole. For wildlife, that specific portion of the habitat for a species which tends to limit the number of animals which can survive in that area, such as key winter range.

KEY HABITAT - See Key Area.

K-V FUNDS - In 1930, Congress passed the Knutson-Vandenberg Act (K-V Act) to authorize collection of funds (K-V Funds) for reforestation and timber stand improvement work on areas cut over by a timber sale.

LAND EXCHANGE - The conveyance of non-Federal land or interests to the United States in exchange for National Forest System land or interests in land.

LAND LINE - For Forest Plan purposes, National Forest property boundaries.

LATE FOREST SUCCESSION - A stage of forest succession where the majority of trees are mature or over-mature.

LEASABLE MINERALS - Minerals such as coal, oil, gas, phosphate, sodium, potassium, oil, oilshale, and geothermal steam which fall under the authority of the Mineral Leasing Act of 1920, as amended.

LINEAR PROGRAM MODEL - A mathematical method used to determine the best use of resources to achieve a desired result when limitations on available resources can be expressed in the form of equations.

LIVESTOCK GRAZING MANAGEMENT LEVELS -

Level A - Livestock grazing is entirely eliminated or restricted to situations where it will meet other resource objectives, such as fuel hazard reduction in recreation areas. Areas managed under Level A are not counted as full capacity range in the determination of livestock forage capacities.

Level B - Livestock grazing is very limited. Management is generally accomplished by moving livestock from one place to another. On areas managed under Level B, capacity and actual use are kept in balance by removing or adding livestock. There is very little structural improvement work done, such as fences or water development, and no forage improvement work.

Level C - Level C management controls livestock use through the use of structural improvements and physical movement of livestock. Long-term capacities are balanced with use through adjustments in numbers of livestock. Any forage improvement is generally the result of meeting other resource objectives, such as wildlife habitat improvement.

Level D - Areas under Level D management are managed intensively for livestock grazing within an overall multiple-use concept. Any structural or nonstructural (forage) improvement technique may be used as long as it fits with the natural environment. All reasonable and approved management techniques are applied to sustain capacity and use at high levels.

Level E - Level E management is applied to areas to achieve the maximum livestock production that the land can support. Any management technique can be applied as long as basic watershed values are protected. Some management activities, such as irrigating or large scale planting of non-native grass species, may change the natural character of the land.

Level U - Unsatisfactory level of grazing management in which the range is overstocked and the general trend in range condition is downward.

LOCAL ROADS - These roads connect terminal facilities with Forest collector or Forest arterial roads, or public highways. The location and standard are usually those required to serve a specific resource activity, such as campground access, or a timber sale, rather than overall travel efficiency.

LOCATABLE MINERALS - Those hardrock minerals which are mined and processed for the recovery of metals, and which qualify for the location of mining claims on public land. May include certain nonmetallic minerals such as valuable and distinctive deposits of limestone or silica. May include any solid natural inorganic substance occurring in the crust of the earth, except for the common varieties of mineral materials and leasable minerals. Locatable minerals are administered under the authority of the general mining laws.

LONG-TERM - Action governed by the Forest Plan generally taking place over a period longer than ten years from the present.

LONG-TERM SUSTAINED YIELD CAPACITY (LTSYC) - The highest uniform wood yield from lands being managed for timber production that may be achieved and sustained under a specified intensity of management consistent with multiple use objectives.

MAINTENANCE - The upkeep of all Forest development transportation facilities, including surfaces and shoulders, parking and side areas, structures, and such traffic control devices as are necessary for its safe and efficient utilization [36 CFR 212.1, FSM 1023.4, 7732.05]. Maintenance is not for the purpose of upgrading a facility, but rather, to bring it to the originally constructed or subsequently reconstructed condition.

MANAGEMENT AREA - An area that has common direction throughout that differs from neighboring areas. The entire Forest is divided into management areas. Each is described, and policies and prescriptions relating to its use are listed.

MANAGEMENT CONCERN - A matter of importance to the management of the National Forest System Lands, which is identified internally by the agency. An issue or problem requiring resolution or a condition constraining management practices.

MANAGEMENT DIRECTION - A statement of multiple-use and other goals and objectives, the management prescriptions, and the associatd standards and guidelines for attaining them. [36 CFR 219.3[r] NFMA Regulations]

MANAGEMENT EMPHASIS - A reflection of allocation choices for an analysis area. Management emphasis, as used in FORPLAN, is a six-letter identifier used to describe (name) a prescription in FORPLAN.

MANAGEMENT INDICATOR SPECIES - See Indicator Species.

MANAGEMENT INTENSITY - The relative cost of a possible management direction and/or management practice.

MANAGEMENT OPPORTUNITY - A statement of general actions, measures, or treatments that address the public issue or management concern in a favorable way.

MANAGEMENT PRACTICE - A specific action, measure, or treatment.

MANAGEMENT PRESCRIPTION - Management practices selected and scheduled for application in a specific area to attain multiple use and other goals and objectives.

MANAGEMENT TEAM - Decision-making group consisting of the Forest Supervisor, Program Staff Officers, and District Rangers.

MARGINAL ANALYSIS - A type of analysis in which the only costs and benefits considered are those about which decisions can be made. Fixed benefits and costs are not considered.

MARKET-VALUED OUTPUTS - Goods and services valued in terms of what people are willing to pay for them rather than go without, as evidenced by market transactions.

MASS MOVEMENT - Downslope unit movement of a portion of the land's surface, i.e., a single landslide or the gradual simultaneous downhill movement of a whole mass of loose earth material on a slope face.

MAUM'S [THOUSAND AUM'S] - A symbol to indicate 1,000 animal unit months of grazing or range forage.

MAXIMUM MODIFICATION [VQO] - A visual quality objective meaning man's activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.

MBF [THOUSAND BOARD FEET MEASURE] - A symbol to indicate 1,000 board feet of wood fiber volume, either in log form or after conversion into lumber.

MEAN ANNUAL INCREMENT [MAI] - The total increase in girth, diameter, basal area, height, or volume of individual trees of a stand up to a given age divided by that age.

MIDDLEGROUND [VISUAL DISTANCE ZONE] - That part of a scene or landscape which extends from the foreground zone to three to 5 miles from the observer.

MIGRATION ROUTE - A travel route used routinely by wildlife in their seasonal movement from one habitat to another.

MIH CODES - Management Information Handbook codes for defined activities, outputs and effects.

MINERAL DEVELOPMENT - The preparation of a proven deposit for mining.

MINERAL ENTRY - The right under the General Mining Law of 1872, as amended, to enter nonwithdrawn public domain land, such as National Forests, and to explore for, extract, and sell certain locatable minerals; protected by the filing of a lode, placer, or mill site claim.

MINERAL ENTRY WITHDRAWAL - Public lands withdrawn from entry under the General Mining Laws and/or the mineral leasing laws.

MINERAL EXPLORATION - The search for valuable minerals on lands open to mineral entry.

MINERAL PRODUCTION - Extraction of mineral deposits.

MINERAL SOIL - Weathered rock materials without any vegetative cover.

MINERALS, COMMON VARIETY - Deposits which, although they may have value for use in trade, manufacture, the sciences, or in the mechanical or ornamental arts, do not possess a distinct, special economic value for such use over and above the normal uses of the general sum of such deposits. May include sand, stone, gravel, pumicite, cinders, pumice [except that occurring in pieces over two inches on a side], clay, and petrified wood. Common variety mineral material disposals are made under the authority of the Mineral Materials Act of 1947, as amended.

MINERALS, LEASABLE - Minerals such as coal, oil, gas, phosphate, sodium, potassium, oil shale, sulphur [in Louisiana and New Mexico], and geothermal steam which fall under the authority of the Mineral Leasing Act of 1920, as amended.

MINERALS, LOCATABLE - Those hardrock minerals which qualify for the location of mining claims on public land. Generally, they are mined and processed for the recovery of the minerals; often metallic. May include certain nonmetallic minerals and uncommon varieties of mineral materials such as valuable and distinctive deposits of limestone or silica. May include any solid, natural inorganic substance occurring in the crust of the earth, except for the common varieties of mineral materials and leasable minerals. Locatable minerals are administered under the authority of the general mining laws.

MINIMUM LEVEL MANAGEMENT - The management strategy that would meet only the basic statutory requirements of administering unavoidable, nondiscretionary land uses, preventing damage to adjoining lands in other ownerships, and protecting the life, health, and safety of incidental users.

MINIMUM STREAMFLOWS - A specified level of flow through a channel that must be maintained by the users of the stream for biological, physical, or other purposes.

MINING CLAIMS - That portion of the public estate held for mining purposes in which the right to exclusive possession of locatable mineral deposits is vested in the locator of those deposits.

MINING PATENTS - See patented mining claims.

MITIGATE - To lessen the severity.

MMBF (MILLION BOARD FEET MEASURE) - A symbol to indicate 1,000,000 board feet of wood fiber volume either in log form or after conversion into lumber.

MODIFICATION (VQO) - A visual quality objective meaning man's activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

MONITORING AND EVALUATION - The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been and how closely management standards have been applied.

MULTIPLE USE - The management of all various renewable surface resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

NATIONAL ENVIRONMENTAL POLICY ACT - An act to declare a National policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality.

NATIONAL FOREST LANDSCAPE MANAGEMENT SYSTEM - The art and science of planning and administering the use of forest lands in such ways that the visual effects maintain or upgrade man's psychological welfare. It is the planning and design of the visual aspects of multiple use land management.

NATIONAL FOREST MANAGEMENT ACT - A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest Plans and the preparation of regulations to guide that development.

NATIONAL FOREST SYSTEM LAND - National Forests, National Grasslands, and other related lands for which the Forest Service is assigned administrative responsibility.

NATIONAL RECREATION TRAILS - Trails designated by the Secretary of the Interior or the Secretary of Agriculture as part of the National system of trails authorized by the National Trails System Act. National recreation trails provide a variety of outdoor recreation uses in or reasonably accessible to urban areas.

NATIONAL REGISTER OF HISTORIC PLACES - A listing (maintained by the National Park Service) of areas which have been designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the Nation as a whole.

NATIONAL WILD AND SCENIC RIVER SYSTEM - Rivers with outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition.

NATIONAL WILDERNESS PRESERVATION SYSTEM - All lands covered by the Wilderness Act and subsequent wilderness designations, irrespective of the department or agency having jurisdiction.

NEPA - See National Environmental Policy Act.

NFMA - See National Forest Management Act.

NO ACTION ALTERNATIVE - The most likely condition expected to exist in the future if current management direction would continue unchanged.

NON-COMMERCIAL FOREST LAND - See "(Forest Land) Not Capable."

NON-DECLINING YIELD - A level of timber production designed so that the planned sale and harvest for any future decade is equal to or greater than the total planned sale and harvest for the preceding decade.

NON-FOREST LAND - Land that has never supported forests and lands formerly forested where use for timber utilization is precluded by development for other use. Includes areas used for crops, improved pasture, residential areas, improved roads of any width and adjoining clearings, and powerline clearing of any width. If intermingled in forest areas, unimproved roads and non-forest strips must be more than 120 feet wide, and clearing more than one acre in size to qualify as non-forest land. The non-forest land is classified as land not suited for timber production.

NON-GAME SPECIES - Animal species that are not usually hunted. This classification is determined by the State Legislature.

NON-STRUCTURAL RANGE IMPROVEMENT - An improvement to grazing land consisting of a modification of existing vegetation. Examples are spraying or plowing sagebrush and seeding to grass.

NONCOMMODITY OUTPUTS - A resource output that cannot be bought and sold.

NONCONSUMPTIVE USE - Those uses of resources that do not reduce the supply. For example: Nonconsumptive uses of water included hydroelectric power generation, boating, swimming, etc.

NONDECLINING YIELD - A level of timber production designed so that the planned sale and harvest for any future decade is equal to or greater than the total sale and harvest for the preceding decade.

NONMARKET VALUED OUTPUTS - Goods and services valued in terms of what reasonable people would be willing to pay rather than go without the output. Those obtaining the outputs do not pay all or part of what they would be willing to.

NONPOINT SOURCE POLLUTION - Sources of pollution that are diffuse in origin, their transportation into receiving water not well defined or constant, their discharge occurring at many diffuse locations, and depending heavily on weather conditions such as rainstorms or snowmelt. Pollution from forest management is of this type.

NOTICE OF INTENT - Written notice to the affected District Ranger by those who intend to engage in mining activity on the Forest.

NOXIOUS WEED - A noxious, destructive, or troublesome plant when found to be in epidemic proportions and of economic importance to threaten the public welfare.

OBJECTIVE - A clear and specific statement of planned results to be achieved within a stated time period. The results indicated in the statement of objectives are those which are designed to achieve the desired condition represented by the goal. An objective is measurable and implies precise time-phased steps to be taken and resources to be used which, together, represent the basis for defining and controlling the work to be done.

OBJECTIVE FUNCTION - A term in linear programming describing the criterion to be optimized in the model. Examples of objective functions are: maximize timber, maximize livestock forage, or maximize present net value.

OBLITERATION - The returning of the land occupied by a road or trail to resource production.

OCCUPANCY TRESPASS - The illegal occupation or possession of National Forest Land.

OLD-GROWTH - The last stage in forest succession. Old-growth habitat is the sum of the physical and biological components of old-growth forest that are essential to maintaining populations of certain old-growth dependent species of wildlife.

ON-SITE SOIL LOSS - The movement of soil away from one point to another location.

OPERATIONS PLAN - A written plan, approved by a Forest Officer, prepared by those engaged in mining activity on the Forest, describing mining and mineral processing activities that will likely cause a significant disturbance of surface resources. An approved Plan of Operations is required prior to an operator undertaking any exploration or development activities which may cause significant surface disturbance.

OPPORTUNITY COSTS - The value of the benefits foregone or given up due to the effect of choosing another management alternative that either impacts existing outputs or shifts resources away from other activities so that they are no longer produced and their benefits are lost.

ORV - Off-road vehicles; this includes all mechanical means of transportation; passenger cars, four-wheel-drive vehicles, trail bikes, and snowmobiles that are capable of traveling over land where no road exists.

OUTPUT COEFFICIENT - Values which relate an acre of land to a particular quantity of output in a specific period of time.

OUTPUTS - The goods, services, products, and concerns which are measurable and capable of being used to determine the effectiveness of programs and activities in meeting objectives. Also goods, and products, or services that are purchased, consumed, or utilized directly by people. A broad term for describing any result, product, or service that a process or activity actually produces.

OVERSTORY - That portion of the forest of more than one story forming the upper layer or uppermost canopy.

PAOT - See "Persons-At-One-Time."

PARTIAL RETENTION (VQO) - A visual quality objective which in general means man's activities may be evident but must remain subordinate to the characteristic landscape.

PARTICULATES - Small particles suspended in the air and generally considered pollutants.

PATENTED MINING CLAIM - A mining claim to which the Federal Government has granted the claimant all surface and some or all mineral rights. Patented mining claims are private land and may be sold or used for purposes other than mining, such as residential or recreational use.

PERENNIAL STREAM - Streams that flow throughout the year and from source to mouth.

PERMITTED GRAZING - Use of a National Forest range allotment under the terms of a grazing permit.

PERSONS-AT-ONE-TIME (PAOT) - A recreation-capacity measurement term indicating the number of people that can comfortably occupy and use a facility or area at one time.

PLANNING AREA - The area covered by a Regional or Forest Plan.

PLANNING CRITERIA - Standards, tests, rules, and guidelines by which the planning process is conducted and upon which judgements and decisions are based.

PLANNING HORIZON - The overall time period considered in the planning process that spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions which would influence the planning decisions.

PLANNING PERIOD - One decade. The time interval within the planning horizon that is used to show incremental changes in yields, costs, effects and benefits.

PLANNING PROCESS - A system that records decisions and activities that result from the process of developing, revising or amending a Forest Plan.

PLANTATION - A forest crop or stand established by seeding or planting of young trees.

POLE TIMBER - As used in timber survey, a size class definition, trees 5.0 to 8.9 inches at DBH. As used in logging operations, trees from which pole products are produced, such as telephone poles, pilings, etc.

POLICY - A guiding principle on which to base a specific decision or set of decisions.

POTHUNTING - Slang term used by professional archaeologists to describe illegal or non-professional collecting of relics.

PRACTICE - See management practice.

PRECOMMERCIAL THINNING - The selective felling, killing, or removal of trees in a young stand primarily to accelerate diameter growth on the remaining stems, maintain a specific stocking or stand density range, and improve the vigor and quality of the trees that remain. A thinning done in a stand of trees not yet of commercial size.

PREDATOR - An animal species that kills and feeds on other animals.

PREPARATORY CUT - Removal of trees near the end of a rotation so as to permanently open the canopy and enlarge the crowns of seed bearers, with the intent of improving conditions for seed production and natural regeneration, as typically in shelterwood systems.

PRESCRIBED FIRE - The intentional application of fire to wildlands fuels under such conditions as allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives of silviculture, wildlife management, etc.

PRESCRIPTION - See management prescriptions.

PRESENT NET VALUE - The difference of net benefits and net costs, each discounted to the present.

PRESERVATION (VQO) - A visual quality objective that provides for ecological change only.

PRESUPPRESSION - Activities required in advance of fire occurrence to ensure effective suppression action. Includes (1) recruiting and training fire forces; (2) planning and organizing attack methods; (3) procuring and maintaining fire equipment and other facilities necessary for the fire program.

PRIMARY CAVITY NESTERS - Wildlife species that excavate cavities in trees for nest sites.

PRIMITIVE ROS CLASS - A classification of the recreation opportunity spectrum characterized by an essentially unmodified environment, where trails may be present but structures are rare, and where there is isolation from the sights and sounds of man.

PRODUCTION POTENTIAL - The capability of the land or water to produce living organisms and their useful features (forage, habitat, wood, etc.).

PRODUCTION-UTILIZATION SURVEYS (P-U SURVEYS) - Surveys of range land to determine where and how much forage is being produced, and how it is being used.

PRODUCTIVITY - See site productivity.

PROGRAM DEVELOPMENT AND BUDGETING - The process by which activities for the Forest are proposed and funded through the Federal Budget.

PROPOSED ACTION - In terms of the National Environmental Policy Act, the project, activity, or action that a Federal agency intends to implement or undertake and is the subject of an environmental assessment.

PUBLIC ACCESS - A road or trail route over which a public agency claims a right-of-way available for public use.

PUBLIC ISSUE - A subject or question of widespread public interest relating to the planning problem.

PUBLIC PARTICIPATION ACTIVITIES - Meetings, conferences, seminars, workshops, tours, written comments, response to survey questionnaires, and similar activities designed and held to obtain comments from the general public and specific publics about National Forest System land management planning.

RANGE ALLOTMENT - A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under a range allotment management plan.

RANGE CAPACITY LEVELS - Levels are described as follows:

No allowable capacity - Lands that are incapable of sustaining grazing by livestock under reasonable management goals. Examples include areas that are incapable of producing vegetation, soils that cannot produce vegetation at a satisfactory rate to protect itself from erosion, and slopes over 45 percent.

Potential Capacity - Lands presently presently incapable of sustaining grazing, but which could be grazed if a management or other improvement were made. Examples are areas denuded but which could be revegetated, areas having a dense tree cover and no forage, or areas requiring access or water development to bring them up to full capacity.

Full Capacity - Land presently stable because effective ground cover is holding soil loss to acceptable levels, where forage is being produced and which is accessible and available to livestock.

RANGE CONDITION - The state of the plant community on a range site in relation to the potential natural plant community for that site. It is usually rated in the general categories of Poor, Fair, Good, or Excellent.

RANGE CONDITION TREND - The direction of change in range condition and soil productivity.

RANGE INVENTORY (ANALYSIS) - The systematic collection and analysis of resource information needed for managing rangeland. Examples are mapping and measuring plant composition, density and vigor.

RANGELAND (RANGE) - Land that supports vegetaion useful for grazing. Vegetation is routinely managed through manipulation of grazing animals rather than cultural practices.

RANGER DISTRICT - An administrative subdivision of the Forest supervised by a District Ranger who reports to the Forest Supervisor.

RARE II - See Roadless Area Review and Evaluation II.

REAL INCOME - Income based on real dollar values (values from which the effect of change in purchasing power of the dollar has been removed).

RECORD OF DECISION -Under CEQ Regulations, a document separate from but associated with an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action.

RECREATION CAPACITY - The number of people that can take advantage of the supply of recreation opportunity without substantially diminishing the quality of the experience sought after.

RECREATION OPPORTUNITY SPECTRUM - A land classification system which categorizes National Forest land into six classes, each class being defined by its setting and by the probable recreation experiences and activities it affords. The six classes in the spectrum are primitive, semi-primitive, non-motorized, semi-primitive motorized,roaded natural, rural, and urban.

RECREATION RESIDENCE SITE - House or cabin permitted on National Forest land for the recreational use of the owner, but not as a primary residence.

RECREATION VISITOR DAY (RVD) - Recreational use of National Forest land which aggregates twelve hours. It may consist of one person for twelve hours, two people for six hours, or any combination that totals twelve hours.

RECREATIONAL RIVER - Wild and Scenic Rivers Act Usage. Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some devlopment along their shorelines, and that may have undergone some impoundment or diversion in the past.

REDUCED SERVICE MANAGEMENT - Management of developed recreation facilities below optimum maintenance standards.

REFORESTATION - The natural or artificial restocking of an area with forest trees.

REGENERATION - (1) The actual seedlings and saplings existing in a stand. (2) The act of establishing young trees naturally or artificially.

REGENERATION CUT - Removal of trees with the intention of establishing a new crop of seedlings.

REGIONAL FORESTER - The Forest Service official responsible for administering a single Region.

REGIONAL GUIDE - The plan developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended, that guides all natural resource management activities and established management standards and guidelines for the National Forest System lands of a given Region. It also disaggregates the RPA objectives assigned to the Region to the Forests within that Region.

REGULATED FOREST - Forest land managed for timber production under sustained yield principles.

REGULATIONS - 36 CFR refers to the Code of Federal Regulations for implementing the National Forest Management Act.

RESEARCH NATURAL AREAS - An area in as near a natural condition as possible which exemplifies typical or unique vegetation and associated biotic, soil, geologic, and aquatic features. This area is set aside to

preserve a representative sample of an ecological community primarily for scientific and educational purposes; commercial and general public use is not allowed.

RESOURCE DATA BASE - Information about resources stored in a computerized system.

REST-ROTATION - A grazing schedule in which the pastures being grazed receive a year of rest for plant recovery.

RETENTION (VQO) - A visual quality objective which in general, means man's activities are not evident to the casual forest visitor.

REVEGETATION - The reestablishment and development of plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through seeding, planting, or other action.

RIGHT-OF-WAY - Land authorized to be used or occupied for the construction, operation, maintenance, of a project facility passing, over, upon, under, or through such land.

RIPARIAN - Referring to land adjacent to perennial streams, lakes, and reservoirs and including other well developed riparian vegetation (primarily intermittent streams). This land is specifically delineated by the transition ecosystem and defined by soil characteristics and distinctive vegetation communities that require free and unbound water.

ROAD DENSITY - The measure of the degree to which the length of road miles occupies a given land area, i.e., 1 mi/sq. mi. is one mile of road within a given square mile.

ROAD MAINTENANCE LEVELS - Levels are described as follows:

Level 1: Road normally closed to vehicle traffic. Basic custodial care to protect surrounding resources and the road investment.

Level 2: Road open to traffic- Level 1 care plus minimum maintenance for passage of high clearance vehicles.

Level 3: Road open for public traffic - Level 2 care plus maintence needed for safe passenger car useage. User comfort (smooth surface) is not emphazised.

Level 4: Road open for public traffic. Level 3 care plus more consideration for safety at higher speeds and more traffic volume. User comfort is a consideration.

Level 5: Road open to public traffic. Level 4 care plus maintenance needed to ensure user safety and comfort. Maintained for highest traffic volumes.

ROAD PRISM - The geometric features of a road structure including all the disturbed area within a given portion of road. These features include the cut bank, ditch, travel surface, and the fill slope.

ROADED NATURAL ROS CLASS - A classification of the Recreation Opportunity Spectrum that characterizes a predominantly natural environment wioth evidence of moderate permanent alternate resources and resource utilization. Evidence of the sights and sounds of man is moderate, but in harmony with general environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of man.

ROADLESS AREA - Undeveloped Federal land within which there are no roads maintained for travel by means of motorized vehicles.

ROADLESS AREAS REVIEW AND EVALUATION II (RARE II) - A National program which had the purpose of identifying areas for wilderness and making recommendations to Congress regarding their designation.

RODENTICIDE - An agent that kills, repels, or controls rodents.

ROS CLASS - See "Recreation Opportunity Spectrum."

ROTATION - The planned number of years between the start of a crop of trees and their final harvest. The rotation age will very according to geographic location, tree species, and management objectives.

ROUNDWOOD - Trees that are used without being milled (fence posts, telephone poles, pulpwood, etc.).

RPA - The Forest and Rangeland Renewable Resources Planning Act of 1974. Also refers to the National Assessment and Recommended Program developed to fulfill the requirements of the Act. The most recent recommended program was done in 1980.

RPA NATIONAL ASSESSMENT - A document compiled by the Secretary of Agriculture every ten years which contains facts and analyses to develop and guide public and private forest and range land policies and programs.

RPA NATIONAL PROGRAM - A document compiled by the Secretary of Agriculture every five years which outlines Forest Service programs for National Forest System management, cooperative assistance to States and private landowners, and research.

RURAL ROS CLASS - A classification of the Recreation Opportunity Spectrum that characterizes an area in which the sights and sounds of man are prevalent and the landscape has been considerably altered by the works of man.

RVD - See "Recreation Visitor Day."

SALVAGE CUTTING - Done to harvest trees in imminent danger of being killed or damaged by injurious agents. Dead and dying trees are included in salvage cuttings.

SAPLING - As used in timber survey, a size class definition; trees 1.0 to 4.9 inches at DBH.

SATELLITE IMAGERY - A pictorial representation of the earth obtained from a satellite.

SATISFACTORY RANGE CONDITION - Rangeland in range condition clas of at least fair with stable or upward trend.

SATISFACTORY WATERSHED CONDITION - Ground cover conditions are effectively maintaining land productivity, and the frequency and severity of damaging floods is within management tolerances.

SAWTIMBER - Trees that will yield logs suitable in size and quality for the production of lumber.

SCARIFICATION - Loosening the topsoil in open areas to prepare for planting, seeding or natural seedfall.

SCENIC EASEMENT - Relative to the Wild and Scenic Rivers Act [P.L. 93-621] 1975, and by definition of the act; the right to control the use of land (including the air space above such land) within the authorized boundaries of a component of the Wild and Scenic Rivers System, for the purpose of protecting the natural qualities of a designated wild, scenic or recreational river area, but such control shall not affect, without the owner's consent, any regular use exercised prior to the acquisition of the easement.

SCENIC RIVER - Wild and Scenic Rivers Act usage. Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

SCOPING PROCESS [NEPA usage] - The public and management activities used to determine the range of actions, alternatives, and impacts to be considered in an environmental impact statement.

SEDIMENT - solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water,gravity, or ice and has come to rest on the earth's surface either above or below sea level.

SEED CUT - A cutting which leaves adequately spaced seed-bearing trees and opens the stand to provide conditions for restocking and establishment of a new stand of trees. Under a shelterwood system, the first of the shelterwood cuttings.

SEEDLING - As used in timber survey, a size class definition; trees less than one inch at DBH.

SELECTION CUTTING - The annual or periodic harvest of trees, usually the oldest or largest trees, individually or in small groups from an uneven-aged forest, as a means for encouraging continous natural reproduction and maintenance of an uneven-aged condition.

SEMI-PRIMITIVE MANAGEMENT AREA - A wilderness management area characterized by moderate opportunity for solitude in a predominately unmodified natural environment, with a moderate degree of trail maintenance.

SEMI-PRIMITIVE MOTORIZED ROS CLASS - A classification of the Recreation Opportunity Spectrum characterized by moderetely dominant alterations by man, with strong evidence of primitive roads and trails.

SEMI-PRIMITIVE NON-MOTORIZED ROS CLASS - A classification of the Recreation Opportunity Spectrum characterized by few modifications by man, and with high probability of isolation from the sights and sounds of man.

SENSITIVE AREAS - Areas of high erosion hazard, areas that may be susceptible to compaction, or areas of unstable slopes.

SENSITIVE SPECIES - Those plant and animal species identified for a Region for which population viability is a concern.

SENSITIVITY LEVEL - As used in Visual Quality Management; a particular degree or measure of viewer interest in the scenic qualities of the landscape.

SERAL - A transitory, developmental stage in the process of ecological succession for a biotic community.

SHEET EROSION - The removal of a fairly uniform layer of soil from the land surface by runoff water, without the development of conspicuous water channels.

SHELTERWOOD CUT - An even-age regeneration system designed to establish a new crop under a protion of the old stand, which provides both the seed source and shelter for the new seedlings. The mature trees are removed in two or more cuts. (1) The preparatory cut removes a portion of the mature trees and is intended to make the remaining trees more wind firm; preparatory cuts may be omitted where windfall is not a major concern. (2) The seed cut removes additional trees with the intent of allowing additional sunlight to reach the forest floor. The new trees become established following the seed cut. (3) The removal cut removes the last of the mature trees.

SHRUB/SEEDLING - A forest successional stage in which shrubs and seedling trees are the dominant vegetation.

SIGHT DISTANCE - In wildlife management, the distance at which hiding cover is effective. (See hiding cover)

SILVICULTURAL SYSTEM - The entire process by which forest stands are tended, harvested, and replaced. It includes all cultural practices performed during the life of the stand such as regeneration cutting, thinning, improvement cutting, and use of genetically improved sources of tree seeds and seedlings. Silvicultural systems can be distinguished as either even- or uneven-aged.

SITE PREPARATION - Preparation of the ground surface before planting or preparing a seedbed for natural regeneration; includes removal of unwanted vegetation, slash, stumps, and roots from a site.

SKID TRAIL - Travelway used to drag or transport trees from the stump to the road.

SLASH - Debris left after logging, pruning, thinning, or brush cutting. It includes logs, branches, bark, and stumps.

SMALL GAME - Birds and small mammals normally hunted or trapped.

SNAG - Standing dead tree larger than six inches in diameter at breast height.

SOFT SNAG - A standing dead tree from which the leaves and most of the branches have fallen and which has started to rot internally.

SOFTWOOD - A conventional term for both the timber and trees belonging to the botanical group, Gymnospermae.

SOIL PRODUCTIVITY - The capacity of a soil in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

SOIL SURVEYS - Systematic examinations of soils in the field and in laboratories for the purpose of describing, mapping and classifying them according to their adaptability and behavior. There are 5 classified orders of surveys, with order 1 being the highest intensity through order 5 (lowest intensity).

SPECIAL CUTTING - Removal of trees for other than silvicultural purposes. This applies to unregulated area such as developed recreation and administrative sites where other uses or values are overriding.

SPECIAL USE PERMIT - A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest land for some special purpose.

STAND - An aggregation of trees or other growth occupying a specific area and sufficiently uniform in composition (species), age arrangement, and condition as to be distinguishable from the forest or other growth on adjoining areas.

STAND EXAMINATION SURVEYS - Procedures used to collect data on Forest stands.

STANDARD - A principle requiring a specific level of attainment, a rule to measure against.

STATE AIR QUALITY REGULATIONS - The legal guidelines for control of air pollution sources in a state.

STRUCTURAL DIVERSITY - Variety in a forest stand that results from layering or tiering of the canopy. An increase in layering leads to an increase in structural diversity.

STRUCTURAL RANGE IMPROVEMENT - Any type of range improvement that is man-made (fences, corrals, etc.).

SUBDIVISIONS - Subdivided land. Areas of previously undeveloped land divided into individual homesites and/or blocks of lots with streets or roads and open spaces.

SUBSOIL - The layer below the soil surface in which roots normally grow.

SUCCESSION - Ecologic succession. An orderly process of biotic community development that involves changes in species, structure, and community processes over time.

SUITABILITY - The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

SUITABLE RANGE - Range which is accessible to livestock or wildlife, and which can be grazed on a sustained yield basis without damage to long-term productivity.

SUITABLE TIMBER LANDS - Forest lands which can be managed for timber production on a sustained yield basis without damage to long term productivity.

SUPPLY - A schedule of the quantity of a product or forest output that will be produced at various prices.

SUPPRESSION (FIRE SUPPRESSION) - Any act taken to slow, stop, or extinguish a fire. Examples of suppression activities include line construction, backfiring, and application of water or chemical fire retardents.

SUSTAINED YIELD - The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the National Forest without impairment of the productivity of the land.

TARGETS - Objectives assigned to the Forest by the Regional Plan.

TENTATIVELY SUITABLE FOREST LAND - Land for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions. There is reasonable assurance that such lands can be adequately restocked as provided in CFR 219.13(h)(3).

TEMPORARY ROAD - A road that will be physically obliterated and seeded after its primary use is completed (i.e., spur road for logging); it will never be used again. (See TERMINAL ROAD)

TERMINAL ROAD - A road closed for a period of time (such as the interval between timber sales in an area), but planned to remain in place and be used again in the future.

THINNING - Cutting made in an immature crop or stand, primarily to accelerate the diameter increment (annual growth) of the residual trees, but also by suitable selection, to improve the average form of the trees that remain.

THERMAL COVER - Cover used by animals to reduce effects of weather; for elk, a stand of coniferous trees forty feet or more tall with an average crown closure of seventy percent or more, and a minimum of thirty acres in size.

THREATENED AND ENDANGERED SPECIES - Threatened and endangered species are animals or plants identified by the Secretary of Interior in accordance with the 1973 Endangered Species Act. Threatened and endangered are separate classifications. Endangered means any species in danger of extinction throughout all or a significant part of its range. Threatened means any species that is likely to become endangered within the foreseeable future throughout all or a significant part of its range. Candidate species are: Category 1 are those species for which there is sufficient information to support listing, Category 2 are those species for which information is actively being sought to determine their status, and Category 3 are those species no longer being considered for listing, but which may be reevaluated if conditions warrant it.

THREE-STEP SHELTERWOOD - An even-aged silvicultural system in which in order to provide a source of seed and/or protection for regeneration, the old crop (shelterwood) is removed in three successive cuttings.

TIERING - Refers to the concept, when preparing an environmental impact statement, of avoiding repetitive discussions of any issues already covered in another, broader, environmental review. Subsequent

environmental documents can incorporate issues already discussed in previous documents by reference only and concentrate on issues specific to the subsequent action.

TIMBER - A general term for the major woody growth of vegetation in a forest area.

TIMBER BASE - The lands within the Forest capable, available, and suitable for timber production.

TIMBER HARVEST SCHEDULE - The quantity of timber planned for sale and harvest, by time period, from the area of land covered by the Forest Plan. The first period, usually a decade, of the selected harvest schedule provides the allowable sale quantity. Future periods are shown to establish that sustained yield will be achieved and maintained.

TIMBER PRODUCTION - The growing, tending, harvesting, and regeneration of regulated crops of industrial wood. Industrial wood includes logs, bolts, or other round sections cut from trees for industrial or consumer use, except fuelwood.

TIMBER SALE - See commercial timber sale.

TIMBER STAND IMPROVEMENTS (TSI) - A loose term comprising all intermediate cuttings made to improve the composition, constitution, condition, and growth of a timber stand.

TOPSOIL - The original or present dark-colored upper soil that ranges from a mere fraction of an inch to two or three feet deep.

TRACTOR LOGGING - Any logging method which uses a tractor as the motive power for transporting logs from the stumps to a collecting point, whether by dragging or carrying the logs.

TRAFFIC SERVICE LEVELS - Definitions of traffic service levels used as a basis for designing appropriate roads to fit the expected need. These are:

> Level A - Traffic is free flowing and mixed, with adequate passing facilities, and will accomodate expected traffic volume without restricting use. Safety features are a part of the design. User costs are minimized. Road surface is stable, smooth and relatively dust free for the normal use season.
>
> Level B - Similar to Level A, but accepts that congestion will occur, and some traffic controls will be needed during peak use periods.
>
> Level C - Traffic flow is slow and restricted, and may require backing or stopping to permit passing. User costs are considered, and a mix of users is allowed.
>
> Level D - Traffic flow is slow and restricted. Two way traffic may require backing to pass. Traffic volume is intermittent and normally associated with a single purpose. Minimal safety features are included. User costs are given little consideration. The road surface may be rough and irregular. Rutting and dusting is controlled only for soil and water protection.

TRAILHEADS - The parking, signing, and other facilities available at the terminus of a trail.

TRANSITORY RANGE - Land that is suitable for grazing use of a temporary nature over a period of time. For example, on particular disturbed lands, grass may cover the area for a period of time before being replaced by trees or shrubs not suitable for forage.

TRANSMISSION PIPELINE - A pipeline which carries gas or liquid from a producing field for central collection facility to a storage or consumption facility, usually over long distances.

TRAVEL MANAGEMENT - The administrative decision on the location and timing of road and trail closures.

TREE OPENING - An opening in the forest cover created by the application of even-aged silvicultural practices.

TRESPASS - The act of going on another's land or property unlawfully.

TSI - See "Timber Stand Improvement."

TWO-STEP SHELTERWOOD - An even-aged silvicultural system in which, in order to provide a source of seed and/or protection for regeneration, the old crop (the shelterwood) is removed in two successive cuttings.

TYPE CONVERSION - The conversion of the dominant vegetation in an area from forested to nonforested or one tree species to another.

UNCONSTRAINED MAXIMUM - Level of management defined as the highest possible level of a given output along with the costs associated with achieving it.

UNDERSTORY - The trees and other woody species growing under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth (the overstory).

UNEVEN-AGED SILVICULTURE SYSTEMS - The combination of action that result in the creation of forests or stands of trees, in which trees of several or many ages grow together. Cutting methods that develop and maintain uneven-aged stands are individual tree and group selection cutting methods.

UNPATENTED MINING CLAIM - A claim made for possession of locatable minerals on public domain land (e.g., National Forests). A properly recorded claim entitles the claimant to reasonable access to the claim and exclusive right to extract and sell valuable minerals from the claim. Unpatented mining claims may be occupied and used solely for mining and related activity.

UNREGULATED HARVEST - This harvest is not charged against the allowable sale quantity, and includes occasional volumes removed that were not recognized in calculations of the allowable sale quantity, such as cull or dead material and noncommercial species and products. It also includes all volume removed from nonsuitable areas. Harvests from nonsuitable areas will be programmed as needed for objectives such as research on experimental forests, to meet multiple use objectives such as research on experimental forests, to meet mutiple use objectives other than timber production, and for improvement of administrative sites.

UNSATISFACTORY RANGE CONDITION - Rangeland in poor or very poor range condition or in fair condition with a downward trend.

UNSATISFACTORY WATERSHED CONDITION - Effective ground cover conditions are such that impairment of land productivty is occuring. The probability and frequency of damaging peak flows exceeds tolerable levels.

UNSUITABLE LANDS - Lands not allocated to timber management or not suitable as determined through the suitability analysis.

URBAN ROS CLASS - A classification of the Recreation Opportunity Spectrum in which the natural setting is dominated by man-made structures and the sights and sounds of man predominate.

USC - United States Code. A codification of all the general and permanent laws.

UTILITY CORRIDOR - A tract of land of varying width forming a passageway through which various commodities such as oil, gas, and electricity are transported.

UTILIZATION STANDARDS - Standards established to guide the use and removal of timber and measured in terms of minimum size and percent soundness.

VARIETY CLASS - A classification system for establishing three visual landscape categories according to the relative importance of the visual features. This classification system is based on the premise that all landscapes have some visual values, but those with the most variety or diversity of visual features have the greatest potential for having a high scenic value.

VEGETATIVE MANIPULATION - The change of one vegetation type to another through some land treatment such as fire, chemicals, etc. This is done to improve forage production, benefit wildlife habitat, or achieve some other desired result.

VERTICAL DIVERSITY - The diversity in an area that results from the complexity of the above ground structure of the vegetation; the more tiers of vegetation or the more diverse the species make-up, or both, the higher the degree of vertical diversity.

VIABLE POPULATIONS - A wildlife or fish population of sufficient size to maintain its existence over time in spite of normal fluctuations in population levels.

VIS (VISITOR INFORMATION SERVICES) - A service provided to the public by National Forests in which the public is supplied with information regarding activities and features on National Forest land.

VIS SITE - Visitor Information Service Site which provides interpretative information (directional, historical, geographic, natural history, etc) to the public.

VISITOR DAY - A statistical measure of visitor use. The use of an area for a total of twelve person hours by one or more people, either continuously or over several visits.

VISUAL DISTANCE ZONES - Areas of landscapes denoted by specified distances from the observer. Used as a frame of reference, in which to discuss landscape characteristics or activities of man. The three zones are Foreground, Middleground, and Background.

VISUAL MANAGEMENT PROGRAM - Also refereed to as "Landscape Management" or "Visual Resource Management"; guiding the use of forest lands in such ways that the visual effects maintain or upgrade the human visual experience. It is the planning and design of visual aspects of multiple-use land management.

VISUAL QUALITY OBJECTIVE (VQO) - A desired level of excellence based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.

Preservation (P). In general, human activities are not detectable to the visitor.

Retention (R). In general, human activities are not evident to the casual Forest visitor.

Partial Retention (PR). In general, human activities may be evident but must remain subordinate to the characteristic landscape.

Modification (M). Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form,line,color, and texture. It should appear as a natural occurrence when viewed in middleground or background.

Maximum Modification (MM). Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Enhancement. A short-term management alternative wich is done with the express purpose of increasing positive visual variety where little variety now exists.

VISUAL RESOURCE - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

WATER YIELD - The total net amount of water produced on the Forest including streamflow and groundwater recharge.

WATERSHED - The entire area that contributes water to a drainage or stream.

WATERSHED CONDITION - A description of the health of a watershed, or portion thereof, in terms of the factors that effect hydrologic function and soil productivity.

WETLANDS - Areas with shallow standing water or seasonal to year-long saturated soils (includes bogs, marshes, and wet meadows).

WFUD (WILDLIFE AND FISH USER DAY)- A unit for measuring wildlife and fish recreation user activities. A unit is the combination of use which aggregates to twelve visitor hours.

WHEELED SKIDDERS - A motorized wheeled vehicle specifically designed to skid logs.

WILD AND SCENIC RIVER CORRIDOR - See "Wild River" and "Scenic River."

WILD RIVER - Wild and Scenic Rivers Act usage. Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

WILDERNESS - Under the 1964 Wilderness Act, wilderness is undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation. It is protected and managed so as to preserve its natural conditions which (1) generally appear to have been affected primarily by the forces of nature with the imprint of man's activity substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and confined type of recreation; (3) has at least 5,000 acres or is of sufficient size to make practical its condition; and (4) may contain features of scientific, educationsk, scenic, or historical value as well as ecologic and geologic interest.

WILDERNESS RECREATION OPPORTUNITY MANAGEMENT AREAS - Delineated areas in wilderness which have different use characteristics and degrees of trail development. The four management areas are Transition, Semi-primitive, Primitive, and Pristine.

WILDERNESS STUDY AREA (WSA) - One of the areas selected by Congress from an inventory of unroaded and undeveloped National Forest lands as having apparent high qualities for wilderness. They will be studied to determine whether they should be recommended for addition to the National Wilderness Preservation System.

WILDFIRE - Any wildland fire that requires a suppression action. This includes all fires not meeting the requirements of a prescribed fire.

WILDLIFE HABITAT - The sum total of environmental conditions of a specific place occupied by a wildlife species.

WILDLIFE STRUCTURE - A site specific improvement of a wildlife or fish habitat, such as a spring development or dugout to provide water, brushpile for cover, nestbox for birds, or rock and log placement in a stream for fish cover and pool creation.

WINTER RANGE - The area occupied by an animal species during the winter.

WITHDRAWAL - Withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values in the area or reserving the area for a particular public purpose or program.

WORK CENTER - A facility where crews assemble and are directed toward their various work assignments. A work center can be located at an administrative site. A work center normally will include storage and shop facilities and may include crew housing.

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Appendix

Appendix A – Public Involvement

CONSULTATION WITH OTHERS AND THE DEVELOPMENT AND FORMULATION OF PUBLIC ISSUES, MANAGEMENT CONCERNS, AND RESOURCE USE AND DEVELOPMENT OPPORTUNITIES FOR THE KAIBAB NATIONAL FOREST

INTRODUCTION: The National Forest Management Act, (NFMA) was approved on October 22, 1976. This act called for the preparation of land and resource management plans for units of the National Forest System. In addition, this law directed the Secretary of Agriculture to provide for public participation in developing, maintaining, and revising these plans. This report is the record of the activities regarding public participation, scoping, and the formulation of public issues, management concerns, and resource use and development opportunities conducted by the Forest Supervisor and staff officers in the process of developing and preparing the Land and Resource Management Plan for the Kaibab National Forest.

The purpose of public participation and scoping is to (1) broaden the information base upon which land and resource management planning decisions are made; (2) insure that the USDA Forest Service understands the needs, concerns, and values of the public; (3) inform the public of USDA Forest Service land and resource planning activities; (4) provide the public with an understanding of Forest Service programs and proposed actions; (5) provide for public participation in the preparation of environmental impact statements in accordance with the requirements of the National Environmental Policy Act (NEPA); and (6) provide for coordination with other public planning efforts.

RARE II: This chronological record begins with the second Roadless Area Review and Evaluation (RARE II). RARE II was begun in 1977 shortly after the approval of the NFMA. RARE II was designed to be an accelerated portion of the land management planning process dealing solely with the roadless-wilderness issue. The RARE II public participation and scoping activities were directed at obtaining comment from individuals, organizations, Indian tribes, and governmental agencies concerning wilderness desirability and suitability. The Kaibab National Forest conducted a series of workshop meetings with the public and governmental agencies. The public was asked to suggest criteria and to evaluate roadless area suitability. Comments relating to wilderness criteria were evaluated at the national level. Comments relating to individual roadless areas were evaluated by local forest officers in accordance with established criteria; changes to roadless areas were made accordingly. The result of the RARE II public participation and scoping process was an inventory of roadless areas suitable for consideration as classified wilderness. Ten roadless areas were identified on the Kaibab National Forest for subsequent evaluation and analysis.

PUBLIC PARTICIPATION: The unaccelerated portion of the land management planning process was carried out in accordance with the approved public participation plan. It formally began on September 12, 1980, with the publication of a Notice of Intent in the Federal Register. News releases were published in several newspapers inviting public participation. In addition, over 3,000 invitations were mailed to individuals and organizations known to use or to be interested in National Forest resources. This included timber sale purchasers, road maintenance and construction contractors, special use permittees, range permittees, fuelwood purchasers, and others that had expressed an interest in National Forest programs. A diligent search was made of the Coconino County tax and property records in order to ascertain owners of property adjacent to National Forest land. Invitations were sent to 246 adjacent landowners. In total, more than 3,100 individuals and organizations were invited to participate in the process. Public workshops were hosted in Tusayan, Fredonia, Williams, Flagstaff, Phoenix, and Tucson, Arizona, to inform the public of the planning process and to invite the public to recommend and suggest public issues, evaluation criteria, and resource use and development opportunities to be addressed in the planning process. Every party invited to participate in the process was provided with a booklet entitled "National Forests in Arizona – Issues, Concerns and Opportunities". This booklet presented basic factual information regarding the budget and resource situation of each National Forest in Arizona. In addition, the booklet was formatted in a manner to invite written comment.

CONSULTATION WITH GOVERNMENT AGENCIES AND INDIAN TRIBES: The scoping process involved federal, state, and local governmental agencies and Indian tribes. Meetings were held in Phoenix, Arizona, to stimulate consultation and provide for information exchange regarding the planning process between the forest officers and agency officials.

There have been informal on-going consultations between forest officers and USDI, Fish and Wildlife Service, Office of Ecological Services. Formal consultation is in progress regarding the 180 day listing period for threatened and endangered plant and animal species.

In addition to formal scoping activities, forest officers have maintained continuous, routine contacts with several federal and State of Arizona agencies. The most significant federal contact involves the district rangers at Tusayan and Fredonia and the Forest Lands and Recreation staff officer with personnel of Grand Canyon National Park. The most important and numerous state contact is the Arizona Game and Fish Department. The wildlife biologist assigned to the forest Interdisciplinary Team has maintained an on-going dialogue with key planning personnel in the department regarding all aspects of the land and resource planning process. Other contacts involve the Bureau of Land Management, USDI; Arizona Department of Transportation; and Arizona State Land Department.

Contact with Indian tribal officials was made through correspondence and meetings. The USDA Forest Service contracted (through the Coconino National Forest) with Dr. Walter M. Vanette of Northern Arizona University to conduct a study to develop Navajo input for the planning process. The objectives of this research were to (1) identify sacred places, (2) identify potential problems to Navajo culture arising from USDA Forest Service activities, (3) identify Navajo uses of the Kaibab Naitonal Forest, (4) determine the extent of Navajo understanding of National Forest purposes, and (5) identify processes to facilitate communication with Navajo people concerning National Forest programs. Dr. Vanette's report has been incorporated into the scoping materials.

CONSULTATION WITH SPECIAL INTEREST ORGANIZATIONS: Forest officers have also been involved in an on-going, informal consultation with the representatives of several special interest organizations. Foremost have been the USDA Forest Service consultation with representatives from the timber industry and wildlife and fish organizations.

The forest wildlife biologist has maintained an on-going dialogue involving all aspects of planning process with representatives of the Arizona Wildlife Federation, the Wildlife Society, the Audubon Society, Museum of Northern Arizona, Coconino Sportsmen, and the Sierra Club. The topic of these consultations have been the general planning process, the identification and selection of management indicator species, and the development of management prescriptions.

The forest timber management staff officer (and members of that staff unit), the land management planning officer and the assistant land management planner have been in consultation, in an on-going basis, with representatives of Southwest Forest Industries, Inc., and Kaibab Industries, Inc. These consultations have also related to all aspects of the planning process, but have focused in particular on, the identification of public issues, management concerns, and resource use and development opportunities; formulation and development of management prescriptions; and the formulation and analysis of planning alternatives.

INTERNAL CONSULTATION: In addition to the public workshops, the Kaibab National Forest hosted two workshops in Fredonia, Arizona, and two workshops in Williams, Arizona, for Forest Service employees. These workshops were intended to inform employees of the planning process, operations involved, the planning schedule, and obtain employee comment regarding issues, concerns, and opportunities. The period for public comment closed on December 8, 1980.

COMMENT ANALYSIS AND ISSUE FORMULATION: The next phase of the public participation and scoping process is referred to as "content analysis". Content analysis is a technique that objectively and systematically identifies, summarizes, and describes the characteristics of a communication.

Five Arizona National Forests established a content analysis group to examine the content of all documents and communications received in the scoping and public participation processes. Every document or piece of communication was assigned a unique identifier upon receipt and then photocopied. The original document is on

file at the appropriate forest supervisor's office. The photocopy was then read, analyzed, and each particular point or comment was identified, sifted out of the correspondence, assigned a unique identifier, copied verbatim on a data processing form and prepared for data entry and computer processing. Each National Forest prepared its computer files and performed its comment sorting and manipulations.

The Kaibab National Forest utilized some optional identifiers in its comment classification and analysis process. Each comment was read and assigned to one of the four following categories. The comment identifier was modified to reflect its category assignment and the kind of output allocation or management activity that it involved.

The forest interdisciplinary team developed a process to screen and classify public comment. This process was based on the supposition that any comment was related to one of four categories and one of the seventeen national management concerns of the Secretary of Agriculture. These categories follow:

Category One: Category One comments relate to outputs and effects. Examples of measurable outputs are dispersed and developed recreation use, softwood sawtimber produced, fuelwood produced, and acre-feet of water. These outputs relate to the right-hand side of the FORPLAN model. Classification of a comment as a Category One comment provides the linkage between public input and the output side of the FORPLAN model. Each Category One comment is also coded with the applicable output code defined in Chapter Three of the USDA Forest Service Management Information Handbook.

Category Two: Category Two comments refer to USDA Forest Service management activities or the specifics of how an activity is carried out. Category Two comments were identified in the forest's comment file by national management concern and the alpha-numeric code for the activity in Chapter Two of the USDA Forest Service Management Information Handbook. Examples of management activities are timber stand improvement, dispersed recreation management-full service level, soil resource improvement, and vegetation treated by burning. Management activities are the basic entities of management practices used in the development and formulation of management prescriptions. Category Two comments influence the columns of the FORPLAN model.

Category Three: Comments assigned to Category Three referred to alternatives or evaluation criteria. This category of comments communicated some perception the public had about what should be applied in judging the merits of an alternative or plan.

Category Three comments can be formatted from the computer data file by category and national management concern and utilized in the formulation of alternatives and evaluation criteria.

Category Four: This category contains those comments that were judged as outside the scope and authority of the forest's planning process. Category Four comments are not considered again in the planning process; nevertheless they can be recalled from the computer file.

The computer assisted comment management system used by this forest provided for classification and identification of each comment by category, national management concern, and management information handbook resource output or management activity. The system provided for sorting and recall of comment by these and other identifiers. This computer assisted comment file system, used in conjunction with a computer program [Quick Query], provided rapid and relatively inexpensive means of sorting, displaying, and managing the voluminous mass of public comment received in the planning process. The most useful report format was comment sorted by [1] category, [2] national management concern, [3] output code, and [4] resource or support activity code.

The ultimate step in the process was the distillation of public comment into a set of public issues, management concerns, and resource use and development opportunities, hereinafter referred to as ICO's, that would provide direction and scope for the planning and analysis process. The basic approach to the communications received was essentially pragmatic: One could not suppose that the contents of a document were not the writer's perception or understanding of the reality of the nature, condition, or role of the Kaibab National Forest. However, the question regarding whether or not a comment was germane to the planning process was subject to criteria established by forest officers, i.e. comment assignment to categories one to four.

ROADLESS AREA RE-EVALUATION: On January 8, 1980, the Federal District Court ruled in favor of the State of California and held that the RARE II final Environmental Impact Statement (EIS) was inadequate. This ruling was appealed to the Ninth U.S. Circuit Court of Appeals. The Appellate Court affirmed the finding of the District Court.

On January 19, 1983, the Assistant Secretary of Agriculture issued additional direction to the Chief of the Forest Service that provided for revised planning and analysis standards. This direction, among other things, required the analysis of the wilderness-roadless area issue in the land and resource management planning process. This change in direction required additional public participation and scoping in order to inform the public of this change and to (1) validate the roadless area inventory, (2) establish and finalize the roadless area boundaries, and (3) establish the scope of the wilderness-roadless area issue.

This period of public participation was begun on June 30, 1983, with the publicaiton of a Notice of Intent in the Federal Register and publication of legal notices in the Arizona Daily Sun newspaper on July 3, 1983, and July 4, 1983. These notices informed the public of the scheduled public open-house meetings and invited them to submit written comment regarding the inventoried roadless areas, adjustments or changes to the boundaries of roadless areas, resource situation in roadless areas, and comments relating to the evaluation of roadless areas.

Maps of each inventoried roadless area were displayed at these open-house meetings. The maps presented (1) the original RARE II inventoried roadless area boundary, (2) the proposed "manageable" roadless area boundaries, and (3) the number of acres in each roadless area. The "manageable" boundary enclosed the roadless areas proposed by the USDA Forest Service for study and analysis in the subsequent planning and analysis process. This area could be contiguous with the original RARE II roadless area boundary or the boundary might have been adjusted to add or eliminate land that met or did not meet roadless area criteria, or to situate the roadless area boundary on a topographic land feature, e.g. ridge top, river, to substantially improve the identification and location of the roadless area boundary.

No comments of substance were received from the public regarding the "manageable or locatable" boundaries for any of the ten inventoried roadless areas in the Kaibab National Forest; neither were any suggestions presented to add new roadless areas to the roadless area inventory. Accordingly, the ten roadless areas as submitted to the public for comment have been validated and were subsequently approved by the Regional Forester for use in the land and resource planning process on October 13, 1983.

PUBLIC ISSUES, MANAGEMENT CONCERNS AND RESOURCE USE AND DEVELOPMENT OPPORTUNITIES

The public issues, management concerns, and resource use and development opportunities approved by the Regional Forester on July 31, 1981, (see Appendix H) were revised in the summer of 1983 in order to structure them in accordance with Section II of the procedural direction of the Associate Deputy Chief in his 1920 letter to the Regional Foresters dated May 31, 1983. Public comment was approached in the revision process as essentially thesis and antithesis, e.g. point vs. counterpoint, output vs. trade-off, consumptive use vs. non-consumptive use, conflict vs. complement, etc. This process structured public comments (theses and antitheses) into public issues, management concerns, and resource use and development opportunities.

These problem statements are the public issues, management concerns, and resource use and development opportunities for the Kaibab National Forest. They are the fruit of the public involvement, scoping, and comment analysis process. These problem statements establish the nature and scope of the planning and analysis process. Forest resource planning develops alternative solutions, i.e. syntheses, for these problem statements. Analysis measures problem resolution of each alternative using the set of evaluation criteria. Decision making selects a particular alternative for implementation.

The following public issues, management concerns, and resource use and development opportunities, and evaluation criteria were approved by the Regional Forester on October 13, 1983, for use in the land and resource planning process for the Kaibab National Forest. Public Issue 13, Minerals Management, and its Corresponding Evaluation Criteria, were subsequently approved by the Regional Forester on May 22, 1985.

COMMERCIAL TIMBER: Provide for sustained level of timber outputs to support local dependent industries. Increase yields through intensive reforestation, timber stand improvement, thinning, and harvesting practices to improve stand stocking and to eliminate age-class imbalances and insect and disease problems. However, other competing forest values, such as wildlife habitats, visual resources, soil and watershed maintenance and protection and concern for the safety and welfare of forest visitors can delay or eliminate increases of timber yields, and reduce financial returns to the federal and local governments.

The results of certain silvicultural practices, (timber stand improvement cuttings, site preparation, and reforestation) and harvesting methods, (commercial thinning, clearcutting, and shelterwood cutting) concern many people who fear (1) depletion of growing stock, (2) erosion and declining soil productivity, and (3) impacts on watershed condition, visual resources, forage production, and wildlife habitats. Opportunities exist for improving the administration and application of silvicultural activities and logging practices and for changing the diversity and distribution of timber stands in terms of stand size, species composition, age composition, tree sizes, and stocking levels, and patterns.

FUELWOOD: Demand for fuelwood continues to increase; however, total use and availability are not well-measured. Some preferred fuelwood sources, such as pine snags, oak, and alligator juniper are in short supply and there is potential to damage resources if overcutting takes place. Significant amounts of ponderosa pine logging slash and similar residues are produced in harvesting and cultural operations and must be treated for disposal. Increased substitution of these materials for preferred sources may improve economic efficiency and forest protection.

RANGE: Provide for sustained level of range outputs in support of local ranches. Significant amounts of rangeland are in unsatisfactory condition in spite of adjusting the number of animals grazed relative to grazing capacity. Recovery of depleted rangeland is slow in many areas because of degraded soil conditions, poor plant composition, and lack of structural range improvements. Range management etivities and rangeland improvement activities may impact wildlife habitats, watershed condition, visual resources, and contribute to soil erosion and declining soil productivity. Opportunities exist for (1) more intensive range allotment management regimes, (2) rangeland improvements through public and private investments, (3) adjustments of grazing use in line with grazing capacity, and (4) the management of a wild burro territory.

WATERSHED: Many watersheds have significant acreages in unsatisfactory condition with declining soil productivity because of such factors as oxidation of soil organic matter, lack of vegetative cover, compaction, soil surface crusting, and erosion. Soil and watershed maintenance and improvement practices have the potential to impact wildlife habitats, visual resources, and yields of other resource outputs; however, opportunities exist for direct watershed and soil resource improvements.

DEVELOPED RECREATION: Some existing recreation developments are deteriorating because of overuse or age, eventually resulting in loss of capacity and uneconomic sites. Opportunities exist for reversing this trend and for increasing developed site capacity through expansion of existing sites and construction of new sites through public and private sector investments.

DOWNHILL SKIING: Significant public interest exists for the development of alpine ski facilities. An opportunity for a ski area exists on Bill Williams Mountain. Capture of this opportunity may impact wildlife habitats, visual resources, watershed condition, and the yield of other resource outputs.

DISPERSED RECREATION: There are opportunities for meeting increased demand for dispersed recreation through the development of hiking trails, horseback riding support facilities, cross-country ski trails, off-road vehicle areas, intrepretative sites and materials, scenic view points, and dispersed water developments. Dispersed recreation use and management practices may impact wildlife habitats and reduce yields of other resource outputs.

Lands suitable for primitive, semi-primitive non-motorized and semi-primitive motorized recreation opportunities are limited in area and distribution in this National Forest. There are opportunities for both increasing the amount and improving the distribution of lands suited for these particular recreation

opportunities. However, changes in the existing spectrum of recreation opportunities may effect the yield of other resource outputs.

Off-road vehicle use can adversely impact particular areas with important and sensitive wildlife, visual resource, and soil and watershed values. Opportunities exist for control of off-road vehicle activities where these resource values are adversely effected.

TRANSPORTATION SYSTEM: There is significant public interest regarding the design standards, location, density, maintenance standards, and cost of both permanent and temporary roads. In addition the public has expressed concern regarding restricting access to forest lands and the resources thereof; however, there is also public recognition that unrestricted access to National Forest lands has sometime resulted in damage to the road system, vandalism of other facilities, and adverse impacts to visual, soil, watershed, and wildlife resources.

There are continuing requests for providing commercial air services between the northern portion of the Kaibab National Forest and nearby air terminals. Commercial air services may impact visual, soil and water, and wildlife values, safety and welfare of forest visitors, and result in noise and air degradation. In addition these kinds of services may be incompatible with the management emphasis and resource management direction for the neighboring north rim area of Grand Canyon National Park and thereby adversely effect National Park programs.

WILDLIFE HABITAT: In some areas, past activities such as timber harvest, snag removal, overgrazing, and road construction have degraded wildlife habitats. Opportunities exist for direct wildlife habitat improvements to restore and provide for quality habitats in many areas of the forest. Wildlife habitat improvements have the potential to impact soil and watershed, timber, visual, and range resources.

CULTURAL RESOURCES: Cultural resource management for this National Forest is a narrowly defined program generally limited to site avoidance. In spite of increased effort to protect and identify cultural resource sites there are continuing losses of cultural resources from vandalism and accidental destruction. Inventoried cultural resource sites are not being evaluated for final disposition, i.e. nomination to the National Register, continuing protection, salvage, etc. Until these evaluations are completed, blanket protection of all sites is necessary.

A portion of the Beale Wagon Road is situated within this National Forest. The National Trails System Act, as amended, requires evaluation of this "road" as a National Historic Trail. A recommendation for administrative action regarding designation of the Beale Wagon Road as a National Historic Trail is necessary. Designation of this road as a National Historic trail may affect the yield of other resource outputs.

WILDERNESS AND SPECIAL AREAS: The Arizona Wilderness Act of 1984 established three wilderness areas in this National Forest. Management direction is necessary to guide the use and management of these areas to protect and maintain their wilderness character and value.

The opportunity exists to establish an Arizona Fescue Research Natural Area. Allocation of land for this purpose may reduce or eliminate the yield of other resource outputs. Evaluation of the opportunity to establish this special area and a recommendation for administrative action is necessary.

LAND OWNERSHIP ADJUSTMENTS: Many administrative problems, such as road access, utility rights-of-way, and property encroachment, occur on National Forest lands that are adjacent to lands in other ownerships. This situation is most acute and concentrated in the vicinity of the established communities of Williams and Tusayan. Opportunities exist to adjust the pattern of National Forest land ownership in the vicinity of these communities in order to allow economic growth and improve National Forest administration.

MINERALS MANAGEMENT: Mineral activities sometimes conflict with other resource values and uses. There is need to (1) ensure access for mineral development and (2) provide adequate protection of special resource values. Mineral withdrawals and surface use and occupancy restrictions can prevent or reduce resource conflicts associated with mineral exploration and development activities.

Oil and gas lease recommendations, including any special surface use stipulations, must be made for pending and future lease applications.

These components of issues will be resolved outside the forest planning process:

Downhill Skiing: The planning and analysis for the development of a ski area on Bill Williams Mountain is address in seperate environmental impact statement.

Minerals Management: The planning and analysis for the proposed Canyon Mine is addressed in a seperate environmental impact statement.

EVALUATION CRITERIA

CRITERIA FOR EVALUATING RESOLUTION OF THE COMMERCIAL TIMBER ISSUE:

1. Annual sale of sawtimber and pulpwood on a sustained basis of not less than 55,300,000 board foot measure (North Kaibab: 45,300 MBM; South Kaibab: 10,000 MBM) to support local dependent industries.
2. Improve stand stocking and age-class balance.
3. Suitable timberland.
4. Stand size.
5. Species composition.
6. Stand stocking level.
7. Stand diversity and distributior.
8. Dwarf Mistletoe infection level.
9. Watershed condition.
10. Wildlife habitats.
11. Soil loss.
12. Visual resource quality objectives.
13. Forage production.
14. Range allotment management.
15. Forest road density and maintenance.

CRITERIA FOR EVALUATING RESOLUTION OF THE FUELWOOD ISSUE:

1. Inventory preferred fuelwood availability and use.
2. Balance fuelwood removals with availability.
3. Increase substitution of pine slash and logging debris for preferred fuelwood sources.
4. Watershed condition.
5. Wildlife habitats.
6. Fuel loading.

CRITERIA FOR EVALUATING RESOLUTION OF THE RANGE ISSUE:

1. Intensity of range allotment management.
2. Range forage improvements.
3. Range structural improvements.
4. Watershed condition.
5. Soil loss.
6. Wildlife habitats.

CRITERIA FOR EVALUATING RESOLUTION OF THE WATERSHED ISSUE:

1. Soil resource improvements.
2. Water resource improvements.
3. Soil loss.
4. Watershed condition.
5. Range allotment management practices.
6. Road density and maintenance.
7. Stand stocking level.
8. Wildlife habitats.
9. Range forage improvements.
10. Range structural improvements.
11. Visual resource quality objectives.
12. Suitable timberland.

CRITERIA FOR EVALUATING RESOLUTION OF THE DEVELOPED RECREATION ISSUE:

1. Maintenance of existing developed site facilities.
2. Increased capacity in existing developed sites.

3. New developed sites through public and private sector investment.
4. Developed site use maintained in balance with developed site capacity.
5. Watershed condition.
6. Soil loss.
7. Road density and maintenance.
8. Wildlife habitats.
9. Suitable timberland.

CRITERIA FOR EVALUATING RESOLUTION OF THE DISPERSED RECREATION ISSUE:

1. Dispersed recreation facilities.
2. Amount and distribution of primitive, semi-primitive non-motorized, and semi-primitive motorized recreation opportunities.
3. Watershed condition.
4. Wildlife habitats.
5. Visual resource quality objectives.
6. Soil loss.
7. Suitable timberland.
8. Commercial fuelwood.
9. Personal use fuelwood.
10. Range allotment management.
11. Road density and maintenance.
12. Area closed to off-road vehicles.

CRITERIA FOR EVALUATING RESOLUTION OF THE TRANSPORTATION SYSTEM ISSUE:

1. Design, density, location, and maintenance standards for all roads and highways.
2. Fixed-wing or helicopter service to North Kaibab area.
3. Watershed condition.
4. Soil loss.
5. Visual resource quality objectives.
6. Personal use fuelwood.
7. Safety and welfare of forest visitors.
8. Noise and air degradation.
9. Compatibility with Grand Canyon National Park programs and resource management direction.
10. Suitable timberland.

CRITERIA FOR EVALUATING RESOLUTION OF THE WILDLIFE HABITAT ISSUE:

1. Wildlife and fish use.
2. Direct habitat improvements in degraded habitats.
3. Watershed condition.
4. Range allotment management practices.
5. Stand stocking levels.
6. Stand size and distribution.
7. Personal use fuelwood.
8. Commercial fuelwood.
9. Suitable timberland.
10. Road density and maintenance.
11. Soil loss.
12. Visual resource quality objectives.

CRITERIA FOR EVALUATING RESOLUTION OF THE CULTURAL RESOURCE ISSUE:

1. Disposition of cultural resource sites.

CRITERIA FOR EVALUATING RESOLUTION OF THE WILDERNESS AND SPECIAL AREA ISSUE:

1. Protection and maintenance wilderness character and values.

CRITERIA FOR EVALUATING RESOLUTION OF THE LAND OWNERSHIP ADJUSTMENT ISSUE:

1. Suitability of National Forest land for exchange.

CRITERIA FOR EVALUATING RESOLUTION OF THE MINERALS MANAGEMENT ISSUE:

1. Acres of proposed mineral withdrawals.
2. Surface use restrictions for:
   Recreation, administrative developments, permitted land uses, sensitive soils

GOVERNMENTAL AGENCIES AND OFFICIALS CONTACED IN THE SCOPING PROCESS

Arizona Congressional Delegation
Governor of Arizona
Arizona Legislative Representatives (local area)
Coconino County Board of Supervisors
Yavapai County Board of Supervisors
Mohave County Board of Superviors
Arizona Attorney General
Arizona Commission of Agriculture and Horticulture
Arizona Department of Transportation
Arizona Game and Fish Department
Arizona Historical Preservation Office
Arizona Office of Tourism
Arizona Outdoor Recreation Coordination Commission
Arizona Resource Information System
Arizona Clearing House
Arizona Department of Health Services
Arizona Department of Mineral Resources
Arizona Land Department
Arizona Parks Board
Arizona State Treasurer
Arizona Water Commission
Governor's Commission on Arizona Environment
Office of Economic Planning
Corps of Engineers, DOD
Bureau of Indian Affairs, USDI
Bureau of Land Management, USDI
Bureau of Reclamation, USDI
Kirkland Air Force Base, Department of the Air Force, DOD
Luke Air Force Base, Department of the Air Force, DOD
Williams Air Force Base, Department of the Air Force, DOD
Navajo Army Depot, Department of the Army, DOD
Department of the Navy, DOD
Department of Housing and Urban Development
Department of Energy
Environmental Protection Agency
Federal Aviation Administration, DOT
Federal Highway Administration, DOT
Fish and Wildlife Service, USDI
National Park Service, USDI
Grand Canyon National Park, NPS, USDI
Geological Survey, USDI
Soil Conservation Service, USDA
Small Business Administration, DOC
Weather Bureau, DOC
Coconino County Highway Department
Coconino County Sheriff
Coconino County Manpower Board
Maine School District, Perks, Arizona
Northern Arizona Council of Governments
School of Forestry, Northern Arizona University
City of Fredonia, Arizona
City of Williams, Arizona
City of Kanab, Utah
Ashfork Public Schools, Ashfork, Arizona
Gila River Community Council
Salt River Pima-Maricopa Council
Colorado River Tribal Council
Cocopah Tribal Council
Quechan Tribal Council
Yavapai Tonto Apache Council
San Carlos Council
Papago Tribal Council

White Mountain Apache Tribal Council
Kaibab Tribal Council
Hopi Tribal Council
Navajo Tribal Council
Hualapai Tribal Council
Havasupai Tribal Council
Pueblo Of Zuni

SUMMARY OF PUBLIC PARTICIPATION AND SCOPING ACTIVITIES

Activity	Date	Location
RARE II Inventory Employee Workshop	7/15/77	Williams, AZ.
RARE II Inventory Public Workshop	7/16/77	Flagstaff, AZ.
RARE II Inventory Public Workshop	7/19/77	Flagstaff, AZ.
RARE II Inventory Public Workshop	8/16/77	Fredonia, AZ.
RARE II Inventory Public Workshop	8/23/77	Tusayan, AZ.
Kaibab Mailer Card	6/10/80	Williams, AZ.
Notice of Intent Published	9/12/80	Washington, DC
LMP Media Releases	10/3/80	Arizona Newspapers
Briefing for Govenor and Staff	10/21/80	Phoenix, AZ
Tusayan Public Meeting	10/27/80	Tusayan, AZ
Fredonia Public Meeting	10/28/80	Fredonia, AZ
Williams Public Meeting	10/29/80	Williams, AZ
Flagstaff Public Meeting	11/7/80	Flagstaff, AZ
Tucson Public Meeting	11/12/80	Tucson, AZ
Phoenix Public Meeting	11/13/80	Phoenix,AZ
Kaibab NF Employees Workshop	10/27/80	Fredonia, AZ
Kaibab NF Employees Workshop	10/30/80	Williams, AZ
Close of Public Comment	12/8/80	
Issues and Concerns Booklet Published	1/9/80	Williams, AZ
Notice of Intent Filed	6/30/83	Albuquerque, NM
Legal Notice Published	7/3-7/4/83	Flagstaff, AZ
Letter of Invitation to Public	7/20/83	Williams, AZ
Media News Release	8/1/83	Williams, AZ
	8/1/83	Tusayan, AZ
	8/1/83	Fredonia, AZ
Tucson Public Open-house	8/3/83	Tucson, AZ
Phoenix Public Open-house	8/4/83	Phoenix, AZ
Williams Public Open-house	8/9/83	Williams, Az
Tusayan Public Open-house	8/10/85	Tusayan, AZ
Fredonia Public Open-house	8/11/83	Fredonia, AZ
Flagstaff Public Open-house	8/31/83	Flagstaff, AZ
Close of Public Comment	10/1/83	

Appendix B – Description of Analysis Process

FOREST PLANNING MODEL

INTRODUCTION

Appendix B describes the planning and analysis processes used in developing the range of alternatives discussed in Chapter 2 of this environmental impact statement.

The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended by the National Forest Management Act (NFMA) of 1976 mandates preparation of National Forest System land and resource management plans. These plans are to provide for multiple use and sustained yield of goods and services from the National Forest System in a way that is sensitive to economic efficiency and maximizes long-term net public benefits in an enviromentally sound manner (36 CFR 219.1(a) and (b)). Regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969 require reasonable alternatives, including the proposed action, be vigorously explored and objectively evaluated (40 CFR 1502.14).

In order to meet these requirements, the Forest developed a quantitative analysis incorporating economics into the process.

The purpose of this process is three-fold: first, it assured that each alternative contains the most cost efficient combination of management activities which meet the objectives of that alternative; second, it provides a means to evaluate or compare alternatives for the purpose of choosing among them; and third, it allows a quantitative starting point from which non-monetary values can be related and discussed.

Forest planning is a complex process. It is necessary to analyze the interrelationships between renewable and non-renewable resources, economic trends, and the social aspects of distributing resources and services to society. The goal is to select the most economically efficient combination of management prescriptions (using a linear programming package called FORPLAN which is described later) that achieve a given set of priced and non-priced goals and objectives from the millions of possible combinations of management emphases which could be applied throughout the Forest.

Computer modeling is a planning technique designed to overcome the complexity of keeping track of the resulting resource outputs, environmental consequences, costs, benefits, and activity schedules applied to the land. This phase of the process is a tool for the manager to use in making a decision. However, based on professional judgment and experience, adjustments in resource distribution are appropriate in order to satisfy implicit socio-political implications, or intangible resource considerations which are not inherent in a mathematical model. Judgmental decisions are described in Chapter 2 and the constraints section of this appendix.

Requirements to be fulfilled in the planning process are described in 36 CFR 219.12. A brief discussion of the steps used on the Kaibab National Forest to complete the planning actions is described below.

Identification of Purpose and Need for Action

Public issues, management concerns, and resource use and development opportunities (known as ICO's) were identified through public participation activities and coordination with other federal agencies, state and local governments and Indian tribes. The development of issues, concerns, and opportunities is described in detail in Appendix A.

Planning Criteria

Planning criteria guide the planning process through: (1) identification of the kind and detail of resource inventories needed; (2) the development of benchmark runs for determining minimum and maximum levels of resource production (decision space) responsive to issues, concerns and opportunities; (3) the formulation and evaluation of alternatives responsive to resolving issues, concerns, and opportunities; and (4) ensuring net public benefits are maximized.

Inventory Data and Information Collection

Individual resource inventories are completed to identify site specific areas having common environmental characteristics. Data are collected and stored in the Forest resource data bases consistent with the available information and the level of detail needed.

Analysis of the Management Situation

The analysis of the management situation (AMS) is a determination of the ability of the Forest to supply goods and services in response to social demands. The primary purpose for this analysis is to provide a basis for formulating a broad range of reasonable alternatives. During development of the AMS document, benchmark runs with single resource emphasis were developed to define the Forest capability to supply various renewable resources on the Forest. Benchmarks were also developed to determine the most cost effective means of managing the Forest.

Formulation of Alternatives

"Formulation of alternatives" is described in Chapter 2 and in the formulation of alternatives portion of this appendix. The primary objective is to provide an adequate basis for identifying the alternative that comes nearest to maximizing net public benefits, consistent with resource integration and management requirements of [36 CFR 219.13 and 219.27].

Estimated Effects and Evaluation of Alternatives

The physical, biological, economic, and social effects of implementing each alternative, considered in detail, provide the analytic basis for comparison of alternatives. This is presented in detail in Chapter 4. To provide a clear basis for decision-making, Chapter 2 presents the major environmental impacts in comparative form in a manner which shows the major differences between the proposed action and the other alternatives. The constraints section of this appendix shows the constraints used to model each planning problem or alternative.

INVENTORY DATA

FORPLAN is a resource allocation and project scheduling linear programming [LP] package. Through the evaluation of the constraints, objectives and resource coefficients supplied by the modeler, scarce resources are allocated to an optimal use. In order for the LP to solve a problem posed as a Forest management alternative, three types of data must be supplied. These are characterized as a description of the land base in discrete units [analysis areas or AA's], a set of management practices that can be applied to the discrete land units in order to achieve a goal [management prescriptions], and a set of consequences which result when a particular management prescription is applied to an AA [coefficients]. The development of these items is discussed below.

Acres tentatively suitable for various management practices within the analysis areas are determined by reviewing their biological capabilities. These acreages provide the framework for developing integrated production coeffients that would meet a range of management objectives for each analysis area.

Production coefficients reflect the number of units per acre or per area of a given resource that can be produced over a specific period of time. These coefficients are estimated for the acreages within the analysis areas that have similar responses to management. Resource specialists make these estimates using the latest research findings, simulation models, literature reviews, field observations, and professional experience. After the coefficients are generated for areas of similar response within the analysis areas, the Forest ID team modified these coefficients as needed to form integrated allocation and scheduling alternatives [resource management prescriptions] for all analysis areas.

The following list summarizes resource data sources used.

Table 145. Resource Data Sources

Forest timber stand examination data
Forest timber inventory data
Forest recreation opportunity spectrum inventory
Forest visual resource inventory
Wildlife field review information
Wildlife species inventory
Terrestrial ecosystem inventory
Forest transportation inventory
Forest fuelwood inventory
Forest fire occurence information
Forest fuels inventory
Range allotment analysis information
Forest precipitation map
Range allotment management plans
Range improvement inventory
Forest land use classification data
RIM data
Forest ten year timber management plan

OVERVIEW AND ANALYSIS PROCESS

Planning consists of exploring the productive potential of the Forest and analyzing alternative strategies for management. This analysis is conducted with a model that is a computerized representation of the Forest, called FORPLAN.

Analysis prior to the use of the FORPLAN model includes formulation of analysis areas, definition of prescriptions, and development of coefficients for both costs and outputs. Cost and output coefficient development involves the use of various analytical models. In defining the inputs to the model that are used in addition to FORPLAN, the ID team integrates resources practices in the most cost efficient way and simulates outputs using the most cost effective practices.

After analysis areas and prescriptions are defined and coefficients are developed, FORPLAN model is used to generate benchmark and alternative solutions. FORPLAN is a linear programming model that simultaneously distributes specific land areas to individual management prescriptions, and schedules use and development activities to achieve a specific set of objectives within certain constraints. Variables that are accounted for by the model include resource outputs, costs, and period of implementation. Given a set of data describing the Forest, an objective function and a set of constraints, the FORPLAN model determines an optimal or best possible solution to the problem. The final objective function of all alternatives is the maximization of present net value. Present net value is the total of discounted benefits minus discounted costs.

The primary use and purpose of the model is to look at the productive potential of the Forest and describe what is and is not possible. Decisions about how to structure the model and the analysis are human choices. Decisions are not made by the model. The model is simply a device used to organize the elements of a decision problem and describe its results.

After the FORPLAN model is used to generate alternatives, a socio-economic model (IMPLAN) is utilized to analyze some social and economic impacts associated with the various alternatives. The IMPLAN analysis is explained in another section of this appendix.

ANALYSIS AREAS

An analysis area (AA) is a parcel of land assumed by the FORPLAN program to respond uniformly, both biologically and economically, to management practices; therefore an AA is assigned common costs and yields. In the Kaibab planning model, the function of AA's is limited to scheduling management practices, e.g. timber management, and estimating the costs, outputs, and effects of the allocated management prescriptions. AA's in the Kaibab model are defined in accordance with criteria established in response to both planning and analysis requirements. These criteria are:

1. maintain area control for legal or administrative purposes;
2. be consistent with the biological factors used to define capability areas;
3. be consistent with the reliability of the inventory data used.

4. respond to differences in economic factors;
5. provide for the resolution of ICO's; and
6. stay within the software limitations of the FORPLAN package.

As displayed in the "Analysis Area" section of this appendix, AA's are defined to address issues and concerns. AA's and the inventory data gathered for each AA are used to determine the acreage that is tentatively suitable for specific management practices and to provide the basic data needed to develop production coefficients.

AA's are defined in the FORPLAN model by the establishment of different identifier or modifier levels. The Kaibab model uses five levels to identify AA's. The following describes each FORPLAN modifier or identifier level and its relation to the criteria above.

Level 1: Land Area
This level defines land area; land areas are basically broad geographic divisions of the Forest. The Kaibab National Forest is comprised of three geographically distinct land areas. This level is designed to model this geographic fact. "WMSCHD" consists of the Williams and Chalender Ranger Districts, which are a contiguous unit. "TUSYAN" is the Tusayan Ranger District which is approximately fifty miles north of Williams and adjacent to the south boundary of the Grand Canyon National Park. "NOKAIB" is the North Kaibab Ranger District which is north of and adjacent to Grand Canyon National Park. The level 1 modifier is established to provide area control for legal or administrative reasons. This definition allows imposition of constraints and formatting of reports by broad geographic divisions of the Forest.

Level 2: Special Areas
This level defines special areas which include the burro management area, developed recreation sites, wilderness areas, research natural areas, undeveloped recreation sites proposed for development, and a designation of tentative suitability for timber production in the remaining lands.

Burro management area: This definition provides for the requirements in the Wild Horse and Burro Protection Act and for trade-offs between burro management and competing resource production.

Developed recreation sites: There is a management concern with developed recreation areas; i.e construction, reconstruction, expansion and new construction of developed sites involving both private and public sector investments. The definition of developed recreation sites in level two (coupled with the level 5 identifiers that define individual recreation sites) facilitate resolution and analysis of this concern.

Classified wilderness areas: This identifier allows the evaluation of various management intensities for classified wilderness areas.

Research natural areas: The administrative status of RNA's removes these areas from multiple-use management, hence, their costs of administration and outputs are different from adjacent lands.

Tentatively suitable lands: This identifier applies to all currently "available" and "capable" lands of less than forty percent slope.

Unsuitable lands: This identifier refers to the remaining lands, e.g. rangeland and coniferous timberland on steep slopes.

Table 146. List of Level 2 Identifiers

SUITIM	Capable, available & tentatively suitable
BURROS	Burro management area
KENDCK	Kendrick Mountain Wilderness
GDPRNA	Garland Prairie Research Natural Area
DEVREC	Developed recreation sites
UNDVRC	Areas considered for recreational developments
KANAB	Kanab Creek Wilderness
SADDLE	Saddle Mountain Wilderness
NOSUTM	Lands not otherwise classified

Level 3: Potential natural vegetation (PNV)
This FORPLAN level modifier is defined by aggregation of capability area kinds (CAK's). Refer to process planning report 2 (found in the process record, Supervisor's Office, Williams) for a detailed discussion of the nature and definitions of CAK's. The relative reliability of the resource inventory data coupled with software limitations of the FORPLAN package intertwined with budget, manpower, and time limitations justified the aggregation of CAK's into the following PNV codes:

SHBGRD: Shrub-grassland PNV (CAK's 8, 9, 10). This is an aggregation of all shrub-grassland CAK's with less than 40 percent slopes and stable soils.

EVGRWD: Evergreen woodland PNV (CAK's 12, 13, 14). This is an aggregation of pinyon pine-Utah juniper, pinyon pine-Utah juniper-big sagebrush, and evergreen woodland CAK's on less than 40 percent slopes and with stable soils.

LIEVWD: Evergreen woodlands on sensitive soils (CAK's 15 & 16). This includes evergreen woodlands CAK's with less than 40 percent slopes and sensitive soils.

CONWDL: Coniferous woodland CAK's (18, 19, 20, 21, 22). This includes coniferous woodland CAK's with less than 40 percent slopes and any soil condition.

STPSEC: Shrub grassland, evergreen woodland, coniferous woodland CAK's on greater than 40 percent slopes and with sensitive soils (11,17,23). This is an aggregation of dissimilar CAK's on steep slopes.

PONFOR: Ponderosa pine Forest CAK's (24, 25, 26, 29, 30, 31). This is all ponderosa pine CAK's with less than 40 percent slopes and any soil condition.

MIXFOR: Mixed coniferous forests CAK's (33, 37). This is an aggregation of Douglas-fir/ponderosa pine and Engelmann spruce/Douglas-fir CAK's with less than 40 percent slopes and stable soils.

SERGRD: Carex and seral grassland (CAK's 7,27, 28, 32, 34, 36, 38). This is an aggregation of Carex sp. and seral grassland with ponderosa pine, Douglas-fir/ponderosa pine, Douglas-fir/ponderosa pine and Engelmann spruce/Douglas-fir CAK's with less than 40 percent slopes and stable soils.

NOTPNV: Lands not otherwise classified in the level 3 identifiers.

Level 4: Timber condition class
There are 17 timber stand condition classes in the timber repeating group of the Forest planning data base.

Table 147. Stand Condition Classes

CODE	STAND CONDITION CLASS
0.	non-forest
1.	in regeneration
2.	damaged pole timber
4.	dwarf mistletoe infected poletimber
5.	dwarf mistletoe infected sawtimber
6.	sparse pole timber
7.	sparse saw timber
8.	low quality pole timber
9.	low quality saw timber
10.	mature pole timber
11.	mature saw timber
12.	immature pole timber
13.	immature saw timber
14.	seedling and sapling adequately stocked
15.	seedling and sapling inadequately stocked
16.	non-stocked
17.	all-aged

For modeling purposes, these 17 classes are collapsed into the following groups.

Table 148. Stand Condition Class Codes

FORPLAN LEVEL 4 CONDITION CLASS	S2K STAND CONDITION CLASS CODE
1. SEEDSS	1, 14, 15
2. IPOLES	8, 12
3. ISAWTR	9, 13, 17
4. MATURE	2, 4, 5, 10, 11
5. SPARSE	6, 7
6. OVEMAT	10, 11
7. NOTAPL	0

Level 5: Individual recreational development sites
This level defines existing and potential recreation development sites. These relate to some of the level 2 modifiers, and permit the modeling of planning problems specific to each site.

Unique combinations of the above five levels of identifiers are used to label analysis areas (AA's). The analysis areas used in our model are described in table 149.

Table 149. Listing of AA for Forest Planning

AA ID	LEVEL1	LEVEL2	LEVEL3	LEVEL4	LEVEL5	ACRES
1	SOKAIB	SUITIM	COMWDL	SEEDSS	NOTAPL	1417
2	SOKAIB	SUITIM	COMWDL	IPOLES	NOTAPL	13352
3	SOKAIB	SUITIM	COMWDL	ISAWTR	NOTAPL	10681
4	SOKAIB	SUITIM	COMWDL	MATURE	NOTAPL	739
5	SOKAIB	SUITIM	COMWDL	SPARSE	NOTAPL	6520
6	SOKAIB	SUITIM	PONFOR	SEEDSS	NOTAPL	7722
7	SOKAIB	SUITIM	PONFOR	IPOLES	NOTAPL	55844

Table 149 (continued). Listing of AA for Forest Planning

8	SOKAIB	SUITIM	PONFOR	ISAWTR	NOTAPL	59890
9	SOKAIB	SUITIM	PONFOR	MATURE	NOTAPL	7525
10	SOKAIB	SUITIM	PONFOR	SPARSE	NOTAPL	19236
11	SOKAIB	NOSUTM	EVGRWD	NOTAPL	NOTAPL	49399
12	SOKAIB	NOSUTM	LIEVWD	NOTAPL	NOTAPL	143145
16	SOKAIB	NOSUTM	PONFOR	SEEDSS	NOTAPL	5882
19	SOKAIB	NOSUTM	PONFOR	IPOLES	NOTAPL	12777
20	SOKAIB	NOSUTM	PONFOR	MATURE	NOTAPL	18628
21	SOKAIB	NOSUTM	PONFOR	SPARSE	NOTAPL	60784
23	SOKAIB	NOSUTM	SERGRD	NOTAPL	NOTAPL	21479
24	SOKAIB	NOSUTM	STPSEC	NOTAPL	NOTAPL	21390
25	SOKAIB	BURROS	EVGRWD	NOTAPL	NOTAPL	10335
26	SOKIAB	BURROS	LIEVWD	NOTAPL	NOTAPL	14081
27	SOKAIB	BURROS	STPSEC	NOTAPL	NOTAPL	2773
AA ID	LEVEL1	LEVEL2	LEVEL3	LEVEL4	LEVEL5	ACRES
28	SOKAIB	KENDCK	PONFOR	SEEDSS	NOTAPL	390
29	SOKAIB	KENDCK	PONFOR	IPOLES	NOTAPL	840
30	SOKAIB	KENDCK	PONFOR	MATURE	NOTAPL	4378
31	SOKAIB	KENDCK	PONFOR	SPARSE	NOTAPL	900
33	SOKAIB	GDPRNA	SERGRD	NOTAPL	NOTAPL	300
34	SOKAIB	DEVREC	NOTPNV	NOTAPL	WHITHS	149
35	SOKAIB	DEVREC	NOTPNV	NOTAPL	DOGTWN	132
36	SOKAIB	DEVREC	NOTPNV	NOTAPL	KAIBLK	187
37	SOKAIB	DEVREC	NOTPNV	NOTAPL	CATRCT	35
38	SOKAIB	DEVREC	NOTPNV	NOTAPL	BWMSKI	721
39	SOKAIB	DEVREC	NOTPNV	NOTAPL	GOLFCS	16
40	SOKAIB	DEVREC	NOTPNV	NOTAPL	OTHREC	56
41	SOKAIB	UNDVRC	PONFOR	ISAWTR	ADAMSD	1848
42	TUSYAN	SUITIM	CONWDL	SEEDSS	NOTAPL	11544
43	TUSYAN	SUITIM	CONWDL	IPOLES	NOTAPL	7133
44	TUSYAN	SUITIM	CONWDL	ISAWTR	NOTAPL	7543
45	TUSYAN	SUITIM	CONWDL	MATURE	NOTAPL	3354
46	TUSYAN	SUITIM	CONWDL	SPARSE	NOTAPL	7109

Table 149 (continued). Listing of AA for Forest Planning

47	TUSYAN	SUITIM	PONFOR	SEEDSS	NOTAPL	4630
48	TUSYAN	SUITIM	PONFOR	IPOLES	NOTAPL	15207
49	TUSYAN	SUITIM	PONFOR	ISAWTR	NOTAPL	1490
50	TUSYAN	SUITIM	PONFOR	MATURE	NOTAPL	811
51	TUSYAN	SUITIM	PONFOR	SPARSE	NOTAPL	4823
52	TUSYAN	NOSUTM	SHBGRD	NOTAPL	NOTAPL	10064
53	TUSYAN	NOSUTM	EVGRWD	NOTAPL	NOTAPL	48224
54	TUSYAN	NOSUTM	LIEVWD	NOTAPL	NOTAPL	170382
60	TUSYAN	NOSUTM	PONFOR	SEEDSS	NOTAPL	1731
61	TUSYAN	NOSUTM	PONFOR	IPOLES	NOTAPL	3820
62	TUSYAN	NOSUTM	PONFOR	MATURE	NOTAPL	5481
63	TUSYAN	NOSUTM	PONFOR	SPARSE	NOTAPL	17881
65	TUSYAN	NOSUTM	SERGRD	NOTAPL	NOTAPL	102
66	TUSYAN	NOSUTM	STPSEC	NOTAPL	NOTAPL	3416
AA ID	LEVEL1	LEVEL2	LEVEL3	LEVEL4	LEVEL5	ACRES
67	TUSYAN	DEVREC	NOTPNV	NOTAPL	TENXCQ	64
68	TUSYAN	DEVREC	NOTPNV	NOTAPL	MOQUIL	50
69	TUSYAN	UNDVRC	PONFOR	ISAWTR	GRNDVW	160
71	NOKAIB	SUITIM	CONWDL	SEEDSS	NOTAPL	583
72	NOKAIB	SUITIM	CONWDL	MATURE	NOTAPL	2665
73	NOKAIB	SUITIM	CONWDL	OVEMAT	NOTAPL	3935
74	NOKAIB	SUITIM	PONFOR	SEEDSS	NOTAPL	20955
75	NOKAIB	SUITIM	PONFOR	MATURE	NOTAPL	51478
76	NOKAIB	SUITIM	PONFOR	OVEMAT	NOTAPL	28770
77	NOKAIB	SUITIM	MIXFOR	SEEDSS	NOTAPL	21048
79	NOKAIB	SUITIM	MIXFOR	OVEMAT	NOTAPL	114204
80	NOKAIB	NOSUTM	SHBGRD	NOTAPL	NOTAPL	36338
81	NOKIAB	NOSUTM	EVGRWD	NOTAPL	NOTAPL	121564
82	NOKAIB	NOSUTM	LIEVWD	NOTAPL	NOTAPL	52912
86	NOKAIB	NOSUTM	PONFOR	SEEDSS	NOTAPL	1012
87	NOKAIB	NOSUTM	PONFOR	MATURE	NOTAPL	31054
88	NOKAIB	NOSUTM	PONFOR	OVEMAT	NOTAPL	1688
89	NOKAIB	NOSUTM	SERGRD	NOTAPL	NOTAPL	3523

Table 149 (continued). Listing of AA for Forest Planning

90	NOKAIB	NOSUTM	STPSEC	NOTAPL	NOTAPL	47942
91	NOKAIB	NOSUTM	MIXFOR	SEEDSS	NOTAPL	217
93	NOKAIB	NOSUTM	MIXFOR	OVEMAT	NOTAPL	7031
94	NOKAIB	SADDLE	EVGRWD	NOTAPL	NOTAPL	32492
95	NOKAIB	SADDLE	PONFOR	SEEDSS	NOTAPL	450
96	NOKAIB	SADDLE	PONFOR	MATURE	NOTAPL	7673
97	NOKAIB	KANAB	EVGRWD	NOTAPL	NOTAPL	67981
98	NOKAIB	DEVREC	NOTPNV	NOTAPL	JACOBL	52
99	NOKAIB	DEVREC	NOTPNV	NOTAPL	JCBLDG	10
100	NOKAIB	DEVREC	NOTPNV	NOTAPL	DMOTCG	17
101	NOKAIB	DEVREC	NOTPNV	NOTAPL	INDHLW	40
102	NOKAIB	DEVREC	NOTPNV	NOTAPL	KABLDG	15
103	NOKAIB	UNDVRC	PONFOR	MATURE	ORDCAN	120
104	NOKAIB	UNDVRC	MIXFOR	OVEMAT	DEMOTT	80
AA ID	LEVEL1	LEVEL2	LEVEL3	LEVEL4	LEVEL5	ACRES
105	NOKAIB	DEVREC	NOTPNV	NOTAPL	OTHREC	12
106	NOKAIB	UNDVRC	PONFOR	MATURE	CHOLKS	10
107	SOKAIB	UNDVRC	PONFOR	ISAWTR	HI64IC	10

PRESCRIPTIONS

Resource management prescriptions are the basis for choice of what can be done in a particular AA. A resource management prescription is the set of resource management practices and a schedule of application that achieves a certain quantity of goods, services, and environmental consequences. Each prescription consists of a set of resource production coefficients, costs, and a scheduling option. The management requirements defined in 36 CFR 219.17 are integrated into prescriptions by modifying the standards and guidelines for work activities, production coefficients, costs, and output coefficients.

A range of prescriptions has been formulated to meet goals and objectives specified in planning criteria, and in the public issues, and management concerns and the resource use and development opportunities developed early in the planning process. Prescriptions range from non-intensive levels of resource management for all resources to very intensive levels of resource management for all resources and non-wilderness uses.

Prescription Formulation

The initial step in the process of formulating resouce management prescriptions is the development of a set of management practices for each resource. A set of management practices, usually five levels of intensity, is developed for the following resource areas: (1) dispersed recreation management, fuelwood management, fish and wildlife habitat improvement, minerals management, forest protection, program management, range management, soil and watershed improvement, timber management, and developed recreation site management. In general, for each resource management practice, the amount of money invested and/or the amount of work involved escalates with each step in the intensity level of the management practice. This increasing intensity is reflected in the number of work activities, and their standard for implementation, that comprises each level of a particular management practice. For example, there are six timber management levels representing all options from no silviculture treatments or cutting to level 5 which is extremely intensive stand management

involving multiple intermediate cuttings and a high degree of investment coupled with an intensive management information gathering and data management system. Also implicit in this system of increasing levels of management intensity is a more intensive concern, awareness and capacity to eliminate or mitigate conflicts and problems involving the management of other resources. Accordingly, by combining all of the least intensive management practices into a management prescription, and applying it to a particular AA, the minimum level of management can be attained on that particular AA, and by the same token, by combining all of the most intensive management practices into a management prescription, and applying it to a particular AA, the-best-of-attainable resource management can be had on that particular AA. It also follows that in the former case the cost of management is the least and in the latter the cost is the most; it also follows that most outputs are non-existent in the former and substantial in the latter. But for most situations, the prudent course of action lies betwixt the two; nevertheless the whole range of management practices is present and available for use.

The Kaibab model contains 48 separate management practices; they are dispersed recreation management, 5 levels; fuelwood management, 6 levels; fish and wildlife habitat improvement, 6 levels; minerals management, 3 levels; forest protection management, 5 levels; program management, 5 levels; range management, 5 levels; soil and watershed improvements, 4 levels; timber management, 6 levels; developed recreation site management, 3 levels; and developed recreation site expansion, 3 levels. Each management practice can be represented by not more than one level in a particular management prescription. Accordingly, the maximum number of unique prescriptions is 56,250 for any suitable timber AA and a like number exists for non-wilderness pinyon-juniper woodland AA's. Expand these combinations by three for land areas involved (level 1 identifiers) and that product by the number of AA's involved and it is obvious why a systematic methodology is necessary to manage the formulation and allocation of resource management prescriptions.

The Kaibab model utilizes 24 categories of management prescriptions or management emphases. Under the umbrella classification of management emphasis there exists a management prescription for every applicable AA. For example, ponderosa pine on tentatively suitable land involves five AA's: (1) seedlings and saplings, (2) poletimber, (3) immature sawtimber, (4) mature sawtimber, and (5) sparse timber. Management emphases ensure that all the timber management practices for all five AA's are coordinated and all other resource management practices that are prescribed for these five AA's are also coordinated and integrated to ensure compatability and efficiency. In short, management emphasis ensures that right hand knows what the left hand is doing and vice-versa. The following table displays the 22 management emphases in the Kaibab model.

Table 150. Description of the Management Emphases

Code	Description of the management emphasis
A	Potential recreation development sites
B	High soil and water emphasis and moderate commodity emphasis
C	Current-no change management
D	Moderate commodity emphasis and moderate non-commodity emphasis
E	High non-commodity emphasis and low-moderate commodity emphasis
F	Low-moderate commodity emphasis and low non-commodity emphasis
G	High commodity emphasis and low to low-moderate non-commodity emphasis
H	High commodity and high non-commodity emphasis
J	High wildlife emphasis and low-moderate commodity and non-commodity emphases
K	Moderate commodity and non-commodity emphases and no timber harvest
L	Low commodity emphasis and low non-commodity emphasis
M	Moderate commodity and moderate non-commodity and no livestock grazing
N	High commodity emphasis and moderate non-commodity emphasis and no timber harvest
P	Moderate high commodity emphasis and moderate non-commodity emphasis
Q	Wilderness area management - standard level 4
R	High non-commodity emphasis and no timber harvest and no livestock grazing
S	Wilderness area management - standard level 5
T	Moderate high commodity emphasis and moderate non-commodity emphasis and no timber harvest
U	Moderate commodity emphasis and moderate non-commodity emphasis and low-moderate fuelwood emphasis
V	Moderate-high wildlife and moderate commodity and non-commodity emphasis and no timber harvest
W	Moderate non-commodity emphasis and no timber harvest and no livestock grazing
X	High non-commodity emphasis and low range management emphasis and no timber harvesting

These were formulated in response to management direction contained in federal regulations, chief's direction, regional forester direction, and as needed to resolve public issues, management concerns, and resource use and development opportunities [ICO's]. There is a direct relationship between the theme of the prescription and the design of alternatives [alternatives are discussed in a later section].

The concept of management emphasis is particularly important and useful if the coordinated allocation and scheduling option of FORPLAN is utilized as is the case in the Kaibab model [this option is discussed in the following section of Appendix B]. Management emphases translate directly into coordinated allocation choices in the Kaibab model. The following table displays the makeup of management practices for each of the 22 management emphases [or coordinated allocation choices] in the Kaibab model. In this table, a "1" indicates the lowest intensity of management; a "5" indicates the highest intensity of management; and "CU" indicates the application of current practices.

Table 151. RELATIONSHIP OF MANAGEMENT PRACTICES TO MANAGEMENT EMPHASIS [COORDINATED ALLOCATION CHOICE]

Management Practice	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	T	U	V	W	X
Dispersed Recreation	D2	D3	D2	D3	D5	D1	D2	D5	D2	D3	D1	D3	D3	D4	D5	D3	D3	D3	D3	D5
Fuelwood [p-j woodland]			F3	F3		F2	F5				F1		F3	F4			F2	F3		
Wildlife Habitat Improv.		H1		H3	H4	H2	H2	H4	H5	H3		H3		H4	H5		H3	H4	H3	
Minerals Management	M1	M3	M3	M3	M1	M3	M5	M5	M1	M3	M3	M3	M5	M5	M1	M5	M3	M3	M3	M1
Forest Protection	N3	N3	CU	N3	N2	N2	N5	N5	N4	N2	N1	N3	N3	N4	N4	N3	N3	N3	N3	N3
Program Management	P5	P3	P2	P2	P3	P1	P4	P5	P3	P2	P1	P2	P2	P4	P3	P2	P2	P2	P2	P3
Range Management	R1	R3	R3	R3	R2	R2	R5	R5	R3	R3	R2	R1	R5	R4	R1	R4	R3	R3	R1	R2
Soil Improvements		S4	S2	S2	S4		S2	S2	S2	S3		S2	S3	S2	S2	S3	S3	S2	S2	S4
Timber Management		T3	CU	T3	T2	T2	T5	T5	T4		T1	T3		T4						
Developed Rec Site Mgt			CU	V3	V2	V2	V3	V3			V1	V3		V3						
Dev Rec Site Expansion				W1			W3							W2						

ALLOCATION ZONES

A practicable plan requires a logical resource allocation and progression of project implementation. In the Kaibab model, AA's are ultimately based on the individual timber stand condition class in the commercial timber type, and terrestrial ecotype in most other areas. To avoid the illogical and unintelligible allocation that occurs in benchmark solutions, the Kaibab opted to use a feature in the FORPLAN package called "coordinated allocation and scheduling". This feature allows the aggregation of contiguous AA's, or pieces of AA's, to form discrete geographic land areas, or allocation zones, where the allocation of the management emphasis, i.e. allocation choice, can be controlled by the problem-solver. This feature is used to eliminate inconsistent management practices in adjacent AA's within a particular allocation zone. Contiguous allocation zones that are allocated the same management emphasis or allocation choice are aggregated to form management areas.

Coordinated allocation zones are not utilized in the benchmark problems. Resource outputs are maximized in benchmark analyses; this requires the generation of all prescriptions, including timing options, for all AA's, and they must be available for selection if the model is to optimize its assigned objective functions.

Allocation zones are delineated to provide spatial control of the allocation of management emphases. This ensures implementability of the Forest plan for the reasons cited above. In addition the utilization of allocation zones provides for the resolution of ICO's. Non-contiguous AA's do not lend themselves to resolution of some public issues; the spatial control provided by allocation zones is needed. For example, issues such as watershed condition and transportation system management are not constituted for efficient resolution across fragmented AA's. A map illustrating the allocation zones is available for review in the planning records located in the Supervisor's Office.

The process for delineating the 45 coordinated allocation zones (CAZ's) in the Williams-Chalender Ranger DIstricts area is based on the following criteria:

1. Major vegetative type.
   A. Woodland
   B. Coniferous woodland
   C. Coniferous forest
   D. Seral grassland

Allocation zone delineations are made for broad, geographically contiguous pieces of land with generally the same PNV in contrast to AA definitions which are tied directly to CAK and thence to PNV and soils. Several PNV classifications may be present in the allocation zone, but vegetative type corresponds to the dominant potential vegetation.

2. Fifth-order watershed. One of the public issues on the Kaibab National Forest addresses watershed condition and soil productivity. This cannot be dealt with effectively using scattered, fragmented AA's. A watershed specification in the allocation zone provides the capability for scheduling and ranking soil and water improvements and treatments.

3. Miscellaneous delineations. The proclaimed Kendrick Mountain Wilderness Area is delineated as a CAZ. All developed recreation sites and potential "developed recreation" sites are excepted from delineation for CAZ's, for reasons described below.

These 45 coordinated allocation zones were subsequently aggregated into 13 larger allocation zones for the purposes and reason cited in the section labelled "Alternative formulation process". The definition of these 13 allocation zones is as follows:

Table 152. Williams/Chelender Zone/AA Relationship

ZONE W1 [Williams and Chelender, west-side, pinyon-juniper

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
1	133	2	865	3	1313	4	13	5	1033	7	52
8	9	10	120	11	29231	12	97753	18	371	19	802
20	1166	21	3826	23	53	24	11244	25	10335	26	14081
27	2773										

ZONE W2 [Williams, pine-woodland transition zone]

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
1	877	2	6176	3	4297	4	405	5	3025	6	1570
7	12453	8	7071	9	1265	10	3659	11	893	12	3599
18	1040	19	2249	20	3279	21	10753	23	124	24	521

ZONE W3 [Williams & Chelender, pine forest]

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
1	145	2	1739	3	2039	4	74	5	784	6	5741
7	39662	8	49485	9	6086	10	14527	11	135	12	24
18	1734	19	3722	20	5512	21	17846	23	20850	24	360
33	300										

ZONE W4 [Kendrick Mountain Wilderness]

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
28	390	29	840	30	4378	31	900

ZONE W5 [Williams & Chelender, north-side, woodland]

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
1	262	2	4772	3	3032	4	247	5	1678	6	411
7	3677	8	3325	9	174	10	930	11	19140	12	41602
18	2737	19	0005	20	8672	21	28359	23	314	24	9265

ZONE W6 [Smoot Lake]

AA	ACRE
12	167

ZONE W7 [Garland Prairie RNA]

AA	ACRE
33	300

The process for delineating the 12 CAZ's in the Tusayan Ranger District is based on the following criteria:

1. Major vegetative types.
   A. Shrub-grassland
   B. Woodland
   C. Coniferous woodland
   D. Coniferous forest

The rationale for these criteria is the same as for the south Kaibab area.

2. Miscellaneous delineations. There are no wilderness areas or other delineations in the Tusayan Ranger District. The same exeptions as are listed for the south Kaibab apply in the Tusayan Ranger District.

These 12 coordinated allocation zones were subsequently aggregated into 4 larger allocation zones for the purposes and reason cited in the section labelled "Alternative formulation process". The definition of these 4 allocation zones is as follows:

Table 153, Tusayan Zone/AA Relationship

ZONE TB (Tusayan woodland)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
42	885	43	272	44	475	45	220	46	858	52	10064
53	33778	54	137378	60	594	61	1474	62	2119	63	6792
66	252										

ZONE TC (Tusayan, woodland, upper basin)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
42	213	43	172	44	873	45	145	46	9	47	36
48	89	50	43	51	25	53	13004	54	27548	60	407
61	773	62	1078	63	3541	66	3164				

ZONE TD (Tusayan, pine woodland, transition zones)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
42	10311	43	5705	44	6100	45	2940	46	5995	47	390
48	1106	49	135	50	148	51	242	53	1442	54	5456
60	608	61	1475	62	2144	63	7079	65	62		

ZONE TE (Tusayan, pine forest)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
42	135	43	984	44	95	45	49	46	247	47	4204
48	14012	49	1355	50	620	51	4556	60	122	61	98
62	140	63	469	65	40						

The process for delineating the 28 CAZ's in the North Kaibab Ranger District is based on the following criteria:

1. Major transportation roadsheds. The North Kaibab Ranger District is divided into three distinct roadsheds or areas served predominantly by one major arterial road. The three roadsheds are: a) US 89A, b) FDR 422, and c) state route 67. These areas are delineated in allocation zones in order to provide for different emphases that are involved with each area. The 89A zone lies north of this highway. Highway 67 is the major arterial route linking the north rim area of Grand Canyon Nation Park with 89A. Management emphasis in this zone can be expected to address management of its visual and scenic resources. FDR 422 is the major arterial for removal of the timber resource from the Forest. The costs, outputs, and management emphases associated with these three major arterial routes are expected to be significantly different.

2. Major vegetative types.
   A. Shrub grassland
   B. Woodland
   C. Coniferous woodland
   D. Coniferous forest
   E. Mixed coniferous forest

The rationale for these criteria is the same as for the south Kaibab area.

3. Miscellaneous delineations. Saddle Mountain and Kanab Creek proclaimed wilderness areas are separate and distinct CAZ's. The same exceptions listed above stand for the North Kaibab Ranger District.

These 28 coordinated allocation zones were subsequently aggregated into 10 larger allocation zones for the purposes and reason cited in the section labelled "Alternative formulation process". The definition of these 10 allocation zones is as follows:

Table 154, North Kaibab Zone/AA Relationship

ZONE N1 (North Kaibab, east side, shrub grassland)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
80	33711	81	13280	82	389	87	67	90	807

ZONE N2 (North Kaibab, woodland)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
71	98	72	1130	73	1599	74	32	75	80	76	1021
80	2627	81	107318	82	52501	86	279	87	7809	88	588
89	67	90	44345								

ZONE N3 (North Kaibab, pine-woodland transition zone)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
71	441	72	1007	73	1694	74	286	75	1457	76	1755
79	328	81	414	82	22	86	473	87	8433	88	435
89	18	90	2172	91	19						

ZONE N4 (North Kaibab, ponderosa pine)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
71	33	72	237	73	289	74	13534	75	29239	76	11150
77	2415	79	4936	86	121	87	7330	88	379	89	487
91	15	93	635								

ZONE N5 (North Kaibab, highway #67 corridor)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
74	3405	75	3388	76	763	77	2215	79	16670	86	5
87	483	88	14	89	2252	91	31	93	1083		

ZONE N6 (North Kaibab, Little Mountain transition zone)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
71	4	72	93	73	111	74	2863	75	11060	76	9493
77	276	79	1394	81	552	86	117	87	4055	88	219
89	63	90	79	93	89						

ZONE N7 (North Kaibab, west-side mixed coniferous forest)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
72	128	73	173	74	483	75	1770	76	2421	77	12314
79	64352	86	9	87	1885	88	30	89	550	91	96
90	329	93	3296	71	7						

ZONE N8 (North Kaibab east-side mixed coniferous forest)

AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE	AA	ACRE
72	70	73	69	74	352	75	4484	76	2167	77	3828
79	26524	86	8	87	992	88	23	89	86	90	210
91	56	93	1928								

ZONE N12 (Kanab Creek Wilderness)

AA	ACRE
97	67981

ZONE N13 (Saddle Mountain Wilderness)

AA	ACRE	AA	ACRE	AA	ACRE
94	32492	95	450	96	7673

Minimum Management Requirements

The regulations for the National Forest Systems Land and Resource Management Planning (36 CFR 219) specifies: 1) the minimum legal management requirements to be met for accomplishing the goals and objectives of the National Forest System (36 CFR 219.27) and 2) the minimum requirements for integrating individual Forest resource planning into the Forest plan (36 CFR 219.14 through 219.26). These are collectively called minimum management requirements (MMR's).

The minimum legal requirements defined in (36 CFR 219.27) can be categorized as either resource protection requirements that must apply to all management prescriptions or to prescriptions which specify practices involving; 1) vegetative manipulation of tree cover for any purpose, 2) timber harvest and cultural treatment, or 3) even-aged silviculture.

The Forest complied with [36 CFR 219.27] primarily within the specific standards and guidelines associated with the individual resource management practices developed for prescription levels.

The low intensity level for each resource contains the standards and guidelines for mitigation measures required to be present in all prescriptions. The low intensity level is the least management activity and cost to meet legal requirements. Therefore, low intensity level standard, activities, costs and outputs are the minimum to be met or exceeded in all other intensity levels, except for the rare cases where current management does not meet legal requirements.

Standards and guidelines which comply with requirements involving vegetative manipulation of tree cover or silvicultural practices were developed primarily for prescription levels other than low intensity where these types of activities were emphasized.

The minimum resource integration requirements specified [36 CFR 219.14 through 219.26] were achieved through the planning process on the Forest and in prescription standards and guidelines. [More complete discussion of MMR's can be found in the Kaibab National Forest technical report on MMR's available at the Forest Supervisor's Office].

In addition to the development of prescriptions, MMR's are considered as right-hand-side constraints. This is necessary in order to ensure that certain output levels are attained or maintained. These include a minimum number of acres assigned to extended rotation prescriptions in order to provide for old-growth habitats; a maximum level of use for the three wilderness areas in the Forest; and, a maximum number of acres that fall into unsatisfactory watershed condition. The constraints are listed below.

Table 155. Minimum Management Requirements

Extended rotation	Min requirement	9%	15%
AA	acres	acres	acres
1	42.	127.	210.
2	400.	1201.	2000.
3	320.	961.	1600.
4	22.	66.	110.
5	195.	586.	975.
6	231.	694.	1155.
7	1675.	5025.	8375.
8	1796.	5390.	8980.
9	225.	677.	1125.
10	577.	1731.	2885.
42	346.	1038.	1730.
43	213.	641.	1065.
44	226.	678.	1130.
45	100.	301.	500.
46	213.	639.	1065.
47	138.	416.	690.
48	456.	1368.	2280.
49	49.	134.	245.
50	24.	74.	120.
51	144.	434.	720.
71	17.	52.	85.
72	79.	239.	395.
73	118.	354.	590.
74	628.	1885.	3140.
75	1544.	4633.	7720.
76	863.	2589.	4315.
77	631.	1894.	3155.
79	3426.	10278.	17130.
TOTAL	14698.	44105.	73490.

Wilderness

Area	RVD's/decade
Kanab Creek	99,000
Saddle Mountain	107,000
Kendrick Mtn	28,000

Watershed condition

Unsatisfactory acres	349,500

COEFFICIENTS

A coefficient is a number that quantifies the value, cost, or amount of an activity or output at a given point in time in the model. Production, or output coefficients for prescriptions are developed by resource specialists on the Forest ID Team for commercial timber, fuelwood, permitted grazing use, grazing capacity, developed, dispersed and wilderness recreation use, wildlife and fisheries recreation, and water yield. Environmental effects are measured by developing coefficients for wildlife habitat and cover; unsatisfactory and satisfactory range condition; unsatisfactory watershed condition; and soil loss. Cost coefficients are developed for activities supporting resource protection and utilization.

Assignment of a prescription to an AA results in outputs and costs calculated in the model from the coefficients for each time period within the planning horizon. Coefficients are either per acre or per area, per year or per time period. Costs relative to managing the Forest and producing goods and services are called "activities".

The planning horizon extends 200 years. It is divided into twenty time periods. Each period is a decade in length.

Not all Forest outputs are included in the FORPLAN model. Some outputs, such as timber, are relatively easy to model. The Forest has control over the harvest of timber along with a legal responsibility to regulate production and the ability to influence the rate of growth of the product. In contrast, mineral production is not controlled by the Forest. The market determines when a mineral resource is utilized.

All coefficients used in FORPLAN are generated and entered in one of two ways. The first method used ECOSIM and a companion utility program to generate coefficients for commercial timber and enter them into FORPLAN; see the timber working group report and the timber technical report in the Forest planning records for additional information on how ECOSIM is used to generate timber output coefficients.

ECOSIM is a computer simulation model for estimating timber growth characteristics over time and the effects of timber treatment and harvest. It is used to estimate all timber inventory changes and harvest volumes for several treatment schedules and silvicultural options. It is also used to estimate timber characteristics such as diameter, basal area, growing stock level, and stems per acre over time.

The method used for other outputs is to manually generate and enter the coefficients. The procedures for doing this are described in detail in the various resource technical reports that are available in the Forest planning records.

OUTPUTS

The FORPLAN outputs and environmental effects and their unit of measurement are as follows:

Table 156. Output/Environmental Effect

Code	Output	Unit
V31B	CONFOR HIDING COVER	ACRE
V32B	CONFOR THERMAL COVER	ACRE
V33B	CONFOR OLD-GROWTH STAGE	ACRE
Q52	DEVELOPED USE-STANDARD	RVD
Q52I	DEVELOPED USE, INCREMENT, STANDARD	RVD
Q53	DEVELOPED USE-LESS THAN STANDARD	RVD
Q55	DEVELOPED RECRECREATION SITE RECEIPTS	DOLLARS

Table 156, Output/Environmental Effect

Q55I	DEVELOPED RECREATION SITE RECEIPTS, INCREMENT	DOLLARS
Q56	PRIVATE USE, OTHER	RVD
Q57	CAMPGROUND USE-PRIVATE	RVD
Q57I	CAMPGROUND USE, INCREMENT, PRIVATE	RVD
Q59	LODGE USE-PRIVATE	RVD
Q59I	LODGE USE INCREMENT, PRIVATE	RVD
W03	SEMI-PRIMITIVE NON-MOTORIZED USE (SPNM), STANDARD	MRVD
W04	SPNM USE- LESS THAN STANDARD	MRVD
W05	SEMI-PRIMITIVE USE (SPM) STANDARD	MRVD
W06	SPM USE- LESS THAN STANDARD	MRVD
W07	ROADED-NATURAL USE, STANDARD	MRVD
W08	ROADED-NATURAL USE, LESS THAN STANDARD	MRVD
Q58	DISPERSED HIWAY USE	RVD
Q62	WILDERNESS USE-STANDARD	RVD
Q63	WILDERNESS USE-LESS THAN STANDARD	RVD
CRCF	CULTURAL RESOURCE CLEARANCE (CUL RES CLEAR), FUELWOOD	ACRES
CRCT	CUL RES CLEAR, TIMBER SALES	ACRES
CRCH	CUL RES CLEAR, WILDLIFE HABITAT IMPROVEMENTS	ACRES
CRCS	CUL RES CLEAR, SOIL & WATER IMPROVEMENTS	ACRES
V51A	NET SAWT MBER	MCF
V51B	NET SAWTIMBER 9-12"	MBF
V51C	NET SAWTIMBER greater than 12"	MBF
V52	NET PRODUCTS	MBF
V52A	NET PRODUCTS	MCF
SCUT	SEED CUTTING	ACRES
THIN	THININGS	ACRES
V53A	FUELWOOD PAID-FUELWOOD SALES	MBF
V53H	FUELWOOD PAID-WILDLIFE HABITAT IMPROVEMENTS	MBF
V53S	FUELWOOD PAID-SOIL & WATER IMPROVEMENTS	MBF
P14F	TREATMENT OF FUELWOOD ACTIVITY FUELS	ACRES
P14T	TREATMENT OF TIMBER SALE ACTIVITY FUELS	ACRES
P14H	TREATMENT OF HABITAT IMPROVEMENT ACTIVITY FUELS	ACRES
P14G	TREATMENT OF D305 ACTIVITY FUELS	ACRES
P14S	TREATMENT SOIL & WATER IMPROVEMENT ACTIVITY FUELS	ACRES
FWAC	CM FULWD ACRES TRTD	ACRES
RDDY	TIMBER SALE ROAD DENSITY	MILES
FPS1	PINE SLASH FUELWOOD INVENTORY1	MBF
FPS2	PINE SLASH FUELWOOD INVENTORY2	MBF
V41A	PERMITTED GRAZING USE	AUM
V42A	GRAZING CAPACITY	AUM
V42B	GRAZING CAPACITY INCREMENT FROM TIMBER SALES	AUM
V42C	GRAZING CAP INC PFL	CUM
V42D	GRAZING CAPACITY INCREMENT FROM SOIL & WATER IMPROVEMENTS	AUM
V49	WILD BURRO USE	ANIMALS
V61W	WATER YIELD WOODLAND	AC-FT
V61C	BACKGROUND WATER YIELD-CONFOR	AC-FT
V61F	INCREMENT WATER YIELD-CONFOR	AC-FT
V62W	BACKGROUND SOIL LOSS FROM WOODLAND	MTONS
V62C	BACKGROUND SOIL LOSS-CONFOR	MTONS
V62U	INCREMENTAL SOIL LOSS WOODLAND	MTONS
V62F	INCREMENTAL SOIL LOSS CONFOR	MTONS
V60	UNSATISFACTORY WATERSHED CONDITION	ACRES
NATM	CONFOR NOT AVAILABLE FOR TIMBER MANAGEMENT	ACRES
EXRT	CONFOR ALLOCATTED TO EXTENDED ROTATIONS	ACRES
V70E	MINERAL CLAIMS-ENERGY	CLAIM
V70N	MINERL CLMS-NON-ENERGY	CLAIM
V75	LEASE-RENTAL ENERGY	ACRES

Table 156. Output/Environmental Effect

V73	URANIUM PRODUCTION	BBTU
V76	MINERAL MATERIALS	MTON
V77	LOCATABLE MINERALS	DOLLARS
GRFB	GRASS-FORB STAGE	ACRES
SBSD	SHRUB-SEEDLING STAGE	ACRES
SPOA	SAPLING-POLES less than 40% CROWN CLOSURE	ACRES
SPOB	SAPLNG-POLES BETWEEN 40% AND 70% CROWN CLOSURE	ACRES
SPOC	SAPLING-POLES greater than 70% CROWN CLOSURE	ACRES
MATA	MATURE less than 40% CROWN CLOSURE	ACRES
MATB	MATURE BETWEEN 40% AND 70% CROWN CLOSURE	ACRES
MATC	MATURE greater than 70% CROWN CLOSURE	ACRES
OLDG	OLD-GROWTH STAGE	ACRES

Benefit Values

Priced outputs given a benefit value in the FORPLAN model are of two types: (1) market outputs and (2) other outputs that are assigned a benefit value. Market outputs are those that have a known measurable value in the marketplace. These include net sawtimber, timber products, all fuelwood, developed recreation and grazing capacity. Other outputs assigned benefit values are those that have no well-defined market value. These include dispersed and wilderness recreation, wildlife and fisheries utilization and water yield.

Benefit values used in the model are shown in Table 157. All benefit values are in first quarter 1982 dollars. All priced benefits are based on the "willingness-to-pay price", whether or not that price is actually charged by the Forest. Those outputs tracked in FORPLAN and not assigned a benefit value in Table 157 are tracked to address issues or for analysis purposes. All priced outputs, with the exception of wildlife and fisheries utilization (wildlife RVD's which are also known as WFUD's), are tracked in FORPLAN; however, all are included in present net value calculations. They are assigned values at the midpoint of each time period in which the benefit occurs. The benefit values remained constant over time. A detailed description of the benefit values and how they are calculated is in the planning records, regional office.

Table 157. Benefit Values for Outputs

Output	Unit of Measure	Benefit Value
Net Sawtimber		
9" - 12" diameter	$/MBF	56.29
12" - 16" diameter	$/MBF	84.84
16" - 20" diameter	$/MBF	94.33
20+ - " diameter	$/MBF	108.00
Net Products	$/MBF	
WMSCHD		9.00
TUSYAN/NOKAIB		0
Wilderness Recreation	$/RVD	
Standard Service Level (STD)		13.75
Less than Standard Service Level (LSTD)		7.29
Developed Recreation	$/RVD	
Standard Service Level		9.47
Less than Standard Service Level		5.02
Dispersed Recreation	$/RVD	
Semi-primitive non-motorized		
STD		13.59
LSTD		7.20
Semi-primitive motorized		
STD		12.59
LSTD		6.67

Table 157. (cont.) Benefit Values for Outputs

Output	Unit of Measure	Benefit Value
Roaded natural		
STD		10.41
LSTD		5.52
Highway use		5.52
Water Yield	$/AC-FT	43.50
Mineral material	$/ton	.28
Uranium production	$/bbtu	3.34
Grazing Capacity	$/AUM	10.34
All Fuelwood	$/MBF	7.75
Wildlife	$/WFUD	
Big Game		30.00
Small Game		18.00
Non-game		25.00
Fishing		13.00
Burros	$/animal	197.91

COSTS

Costs are represented in the FORPLAN model as first quarter 1982 dollars.

When possible costs are tracked by some unit of output. This allows the development of fewer unit costs and still provides a wide range of costs between prescriptions. When it is not possible to track a cost as a unit cost, the total cost of implementing a prescription is calculated and the cost item is entered in FORPLAN as dollars per area or dollars per acre.

Real price increases in costs are not used. It is estimated that all costs would increase at the same rate as inflation. Any change in costs through time is a result of an increase in management intensity.

Activities tracked in FORPLAN are displayed in the following table. Units of measure displayed in the table are the activity units by which costs are tracked. Unit costs multiplied by the actual activity units calculated in FORPLAN result in total costs for the activity. If the activity units are dollars, the costs are entered into FORPLAN as dollars and not tracked per unit of activity. All costs and benefits that are tracked in the FORPLAN model and are assigned at the point that they are expected to occur.

Table 158. Activity Code Index

Code	Activity	Units
A201	DEVELOPED RECREATION (DEV REC) OPERATION & MAINTENANCE (O&M) STANDARD (STD)	DOLLARS
A211	DEV REC O&M INCREMENT (INCR) STD	DOLLARS
A202	DEV REC O&M LESS THAN STANDARD (LSTD)	DOLLARS
A212	DEV REC O&M INCR LSTD	DOLLARS
A203	DEV REC FOREST SERVICE (FS) O&M PRIVATE SECTOR (PVT SCTOR)	DOLLARS
A213	DEV REC FS O&M PVT SCTOR INCR	DOLLARS
A204	DISPERSED (DISP) REC O&M STD	DOLLARS
A205	DISP REC O&M LSTD	DOLLARS
A301	DEVELPD SITE CONSTRUCTION	DOLLARS
A311	DEV SITE CONSTN INCR	DOLLARS
A302	DISP REC INVESTMENTS (INV)	DOLLARS
A303	NON-FS DEV REC INV	DOLLARS
A313	NON-FS DEV REC INV INCR	DOLLARS
A304	NON-FS DEV REC O&M A304	DOLLARS
A314	NON-FS DEV REC O&M INCR	DOLLARS
B101	WILDERNESS MANAGEMENT (MGT) STD	DOLLARS
B102	WILDERNESS MGT LTSD	DOLLARS
C201	WILDLIFE-FISH O&M	DOLLARS
C31A	WILDLFE-FISH HABITAT (WILDHAB) BROWSE IMPROVEMENT (IMPVR)	ACRES
C31B	WLDHAB SEED/PLANTING	ACRES
C31C	WLDHAB IMPVR W/FIRE	ACRES
C31D	WLDHAB ASPEN IMPRV	ACRES
C32A	WETLAND STRUCTRL	STRCTRS
C32B	AQUATIC STRUCTURES	STRCTRS

Table 158 (continued). Activity Code Index

Code	Activity	Units
C32C	WATER CATCHMENTS	STRCTRS
C32D	FISH HABITAT IMPRV	STRCTRS
D201	RANGE RESOURCE O&M	DOLLARS
D301	RANGE STRCTURAL IMP FS	STRCTRS
D303	RANGE STRCTURAL IMP PERMITTEE	STRCTRS
D305	RANGE NONSTRUCTURALL RETREATMENTS FS	ACRES
E401	SITE PREP FOR NATURAL REGENERATION	ACRES
E402	REFORESTATION -W/SITE PREPARATION	ACRES
E501	PRECOMMERCIAL THINNING	ACRES
E804	PURCHASER ROAD CONSTRUCTION	MILES
E813	SAWTIMBER SALE PREPARATION, 9-12"	MBF
E823	SAWTBR SALE PRP greater than 12"	MBF
E805	ROUNDWOOD TIMBERSALE	MBF
E806	FUELWOOD PAID COSTS	ACRES
E801	TIMBER RESOURCE PLANNING & INV	ACRES
SEX3	SILVICULTURAL EXAMINATION LEVEL 3	ACRES
SEX4	SILVI EXAM LEVEL 4	ACRES
F201	SOIL-WATER-AIR RESOURCE OPERATIONS	DOLLARS
F202	MAINTENANCE, SOIL & WATER IMPROVEMENTS	ACRES
F301	SOIL-WTR-AIR RESOURCE IMPROVEMENTS	ACRES
F302	ROAD OBLITERATION	ACRES
G101	MINERALS MANAGEMENT	DOLLARS
P201	FOREST FIRE PROTECTION	DOLLARS
P301	FUEL TREATMENT	ACRES
J201	LAND AND RESOURCE PLANNING	DOLLARS
J301	LAND OWNERSHIP PLANNING	DOLLARS
L201	ROAD MAINTENANCE	DOLLARS
L202	FA&O FACILITIES MAINTENANCE	DOLLARS
L301	FA&O CONSTRUCTION	DOLLARS
L302	ARTERIAL-COLLECTOR ROAD CONSTRUCTION	MILES
T101	GENERAL ADMINISTRATION	DOLLARS
FFF	FFF COST	DOLLARS

ECONOMIC EFFICIENCY

Efficiency is the relationship between the quantity of an input and the amount of the resulting output. One of the primary measures of economic efficiency is present net value.

Present net value (PNV) is defined as the discounted difference between the dollar value of all priced outputs and the dollar value of all expenditures for management and investment. These are discussed in the previous section. The greater the PNV, the greater the net economic return. First quarter 1982 is used as the base and four percent is the discount rate in determining PNV. No output is valued beyond the demanded level.

Economic efficiency is one of the driving forces in planning. As a result, all alternatives have the maximization of PNV as the final objective. This objective alone has the effect of maximizing the economic return from the Forest. There are, however, desired benefits that cannot be converted to monetary returns. These are called non-priced benefits and include such things as reduction in soil loss, management and maintenance of natural and scientific areas; historical and archaeological sites; visual quality; biotic diversity, and recreation quality. These non-priced benefits were included in the model as constraints and as coefficients that reflected the costs of managing for these benefits. Non-priced benefits, together with the sum of PNV, yield net public benefit, which is a more inclusive measure of total social benefit.

ANALYSIS PRIOR TO FORMULATION OF ALTERNATIVES

BENCHMARK ANALYSIS

Prior to alternative development, analyses are conducted to define the range within which integrated alternatives can be constructed. Benchmark analyses set the thresholds of feasibility for the alternative development decision space. An analysis of the management situation is completed to determine the ability of the planning areas to supply goods and services [36 CFR 219.5 [a]). A table of supply and projected demand for key outputs is given in Chapter 3 of

the proposed Forest plan. The purpose of the analysis is to evaluate the potential for multiple uses in formulating a reasonable range of alternatives. Nine benchmarks, representing a broad range of feasible options, are generated through the FORPLAN model to identify opportunities for resolution of issues, concerns, and opportunities and to delineate the limits of the decision space, given physical, biological, and legal criteria, in which feasible alternatives for resource mixes can be considered.

Maximum benchmarks analyses fall into two categories. First, the monetary benchmarks projected maximum present net value of those resouces having an established market value or an assigned value. Second, the biological and physical benchmarks maximized various resource outputs.

The objectives of these analyses are:

1. Explore the maximum economic and biological use, and development opportunities of individual resources.

2. Evaluate capabilities between priced and non-priced resource outputs and effects.

3. Determine the ability of the Forest to respond to major issues and concerns.

In addition to meeting the objectives, the benchmark analyses:

1. Comply with the minimum legal management requirements of 36 CFR 219.27.

2. Estimate the schedules of management activities, resource outputs, effects, discounted benefits and costs, PNV, and acreage of prescription assignments appropriate to achieving the purposes of the benchmark.

3. Are approximately implementable.

4. Are not constrained by budget, except for the "low budget" and "current direction" benchmarks.

5. Use a "maximum PNV" objective function to obtain a final analytical solution when FORPLAN is used.

Each FORPLAN benchmark consists of one or more objective functions and a set of constraints. Prior to describing the benchmarks in detail, the objective functions and constraints used in this analysis are clearly defined. The objective functions are defined in Table 159 which follows. Constraint definitions are contained in two seperate tables: Table 160 defines the timber legal and policy constraints that are used in both benchmarks and alternatives. Other commonly applied constraints are contained in Table 161. The definition of each objective function and constraint contains a three or four character code which is used as an abbreviation in the discussion of the benchmark analyses which follows these tables.

Table 159. Objective Functions Used in Benchmarks and Alternatives

Code	Definition and Discussion
PVA	Indicates that both assigned and market benefit values are used to determine present net value.
PVM	Indicates that only market benefit values are used to determine present net value.
TIM	This is the net merchantable timber volume harvested in the first decade.
GRZ	This is the sum of the grazing capacity over the planning horizon.

Note to the reader: The PVA objective function is the only objective function that is used in most benchmark and alternative computer runs. For some benchmark analyses, two objective functions are used in two consecutive runs. These "roll-over" runs set the results of the initial objective function as ceilings (or floors) of the subsequent run, which has an objective of maximizing PNV.

Table 160. Timber Legal and Policy Constraints Used in Benchmarks and Alternatives.

Code	Definition and Discussion
EI =	This is known as the "ending inventory" constraint. It specifies that the Forest inventory at the end of the planning horizon must be greater than or equal to the average inventory of the regenerated stands. The idea behind this legal requirement (36 CFR 219.16 [a][2][iv]) is to have enough inventory to maintain a perpetual timber harvest.
NDY =	This policy constraint is known as the "nondeclining yield constraint" (36 CFR 219.16 [e][1]). This specifies that the timber sale quantity planned in each decade must be greater than or equal to the quantity planned in the preceding decade. LTSYC (long-term sustained yield capacity) is defined (36 CFR 219.3) as "the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with a multiple use objective." NDY is linked to LTSYC through a constraint that specifies that the timber harvest in the last decade is less than or equal to LTSYC.
SLUB =	The purpose of sequential lower and upper bounds is to control the rate of timber harvest increase and decrease (from one decade to the next) when the NDY constraint is not enforced. Because benchmarks must be approximately implementable a SLUB of plus 35 percent or minus 25 percent was used in this analysis.
CMAI =	The culmination of mean annual increment policy (36 CFR 219.16) states that in "...accordance with the established standards, assure that all even-aged stands scheduled to be harvested during the planning period will generally have reached culmination of mean annual increment of growth." This means that the total yield from each regenerated stand at harvest age is equal to or greater than 95 percent of the volume corresponding to CMAI.

Note to the reader: All of the constraints defined in this table are based on the net merchantable timber volume harvested in cubic feet.

Table 161. Other Commonly Used Constraints.

Code	Definition and Discussion
MMR =	The standards and guidelines for most MMR's (minimum management requirements) are incorporated into the standards and guidelines of the prescriptions. An exception to this is a requirement for a minimum number of acres in old-growth, wilderness use and unsatisfactory watershed condition acres; these are defined as FORPLAN 'absolute' constraints. See Table 155 for the actual values.
BUD =	The budget constraint only is used for one of the benchmark runs. The "current" benchmark used $7,300,000 as an upper limit in the first two decades. The "low budget" benchmark used $6,075,000 (i.e., 75 percent of current) as the upper limit in the first five decades.
RXC =	Prescription controls are used to specify either that certain prescriptions are used for a particular run, or that certain prescriptions are excluded from consideration in a given run. This constraint is used in one benchmark run. The "current" benchmark is constrained to only use of current prescriptions in the solution.
CEIL =	A ceiling is placed on timber harvest volume in the first decade at 75 MMbf. This matches the quantity specified in the current timber management plan.

The definition of each benchmark analyzed by the Forest follows:

1. Minimum Level: The "minimum level" defines the least cost program for keeping the Forest in public ownership. It provides for protection of soil and water resources and productivity of the land. This benchmark also provides for the protection of life, health, and safety of the users of the Forest. The prevention of environmental damage to adjoining lands or downstream areas, and the administration of established special uses and minerals also is assured. The minimum level benchmark is determined outside of FORPLAN. Its purpose is the identification of naturally-occuring outputs that are produced without direct management actions and associated costs.

2. Basic Model Validation Run. The purpose of this run is to debug the model. Hence, the results of this analysis are not displayed in this document. The results are available in the planning records in the Forest Supervisor's Office.
   Objective Function: PVA
   Constraints: NDY, CMAI, EI.

3. Maximize Period 1 Timber Production Benchmark. This run maximizes timber production in decade 1.
   Objective Function: TIM with automatic PNV rollover (using PVA).
   Constraints: NDY, CMAI, EI.

4. Maximize PNV with Assigned Values. This is a monetary benchmark. The PNV produced in this run is used as the reference point in Chapter 2 to evaluate the impact on PNV resulting from constraints in other runs. This run represents the most cost efficient method of managing the Forest when all priced outputs (market and nonmarket) are included in the objective function.
   Objective Function: PVA.
   Constraints: NDY, CMAI, EI, MMR.

5. NDY: Evaluation of the NDY Constraint Benchmark. This run can be compared with the fourth benchmark in order to evaluate the opportunity cost of the NDY constraint.
   Objective Function: PVA.
   Constraints: SLUB, CMAI, EI, MMR.

6. Maximize PNV with Market Values. This is another monetary benchmark. It represents the most cost efficient method of managing the Forest based on resources having established market values since only market outputs are assigned benefit values in the objective function.
   Objective Function: PVM.
   Constraints: NDY, CMAI, EI, MMR.

7. Low Budget Benchmark. This benchmark is used to define the lower end of the feasible and legal decision space; it represents the lowest intensity of management which realistically can be implemented.
Objective Function: PVA.
Constraints: NDY, CMAI, EI, MMR, BUD.

8. Current Benchmark. This is the "no action" alternative. It is used to evaluate the consequences of continuing the current program with current standards and guidelines.
Objective Function: PVA.
Constraints: NDY, CMAI, EI, MMR, CEIL, BUD, RXC.

9. Maximize Grazing Benchmark. This run maximizes grazing capacity over the entire planning horizon.
Objective Function: RNG with automatic PNV rollover (using PVA).
Constraints: SLUB, CMAI, EI, MMR.

A summary of important outputs, activities and costs from benchmarks and planning alternatives is found in the table below. The entire set of FORPLAN benchmark and planning alternative datasets and reports is located in the process records in the Forest Supervisor's Office.

Table 162. Average Annual Output by Benchmark and Planning Alternative

Output: Net Merchantable Timber (MMCF)

Benchmark	Period							
	1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	23	23	23	23	23	23	23	23
#4 Max PNV assigned	22	22	22	22	22	22	23	23
#5 NDY Eval.44	33	25	19	14	24	21	22	
#6 Max PNV market	22	22	22	22	22	22	22	23
#7 Low Budget	10	11	22	22	22	22	22	23
#8 Current Level	12	16	23	23	23	23	25	25
#9 Max Grazing capacity	42	31	23	27	16	17	16	21
#10 Alternative B (RPA)	15	16	18	19	19	19	21	21
#11 Alternative C (NCM)	13	14	14	16	16	16	16	18
#12 Alternative D (COM)	14	16	19	19	19	19	19	19
#13 Alternative E (MXB)	20	22	22	22	22	22	22	23
#14 Alternative PA (PREF)	14	16	16	16	16	16	19	21

Table 162 [continued], Average Annual Output by Benchmark and Planning Alternative

Output: Net Sawtimber and Roundwood (ASQ) [MMBF]

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	117	117	116	111	114	115	115	116
#4 Max PNV assigned	112	114	105	109	107	111	113	110
#5 NDY Eval.	221	169	114	81	67	119	105	108
#6 Max PNV market	110	113	100	108	106	107	108	107
#7 Low Budget	49	55	109	108	111	106	108	115
#8 Current Level	63	79	116	110	114	110	121	124
#9 Max Grazing capacity	200	161	116	100	76	79	79	95
#10 Alternative B [RPA]	73	82	90	94	93	88	101	105
#11 Alternative C [NCM]	67	71	72	77	76	73	76	87
#12 Alternative D [COM]	70	83	99	96	95	87	95	94
#13 Alternative E [MXB]	100	115	110	110	107	108	111	113
#14 Alternative PA [PREF]	73	82	79	78	90	77	94	100

Output: LRSY [MMCF]

Benchmark	
#1 Min Level	0
#3 Max Timber 1st Decade	24
#4 Max PNV assigned	24
#5 NDY Eval.	22
#6 Max PNV market	23
#7 Low Budget	22
#8 Current Level	25
#9 Max Grazing capacity	20
#10 Alternative B [RPA]	21
#11 Alternative C [NCM]	18
#12 Alternative D [COM]	20
#13 Alternative E [MXB]	23
#14 Alternative PA [PREF]	21

Table 162 [continued], Average Annual Output by Benchmark and Planning Alternative

Output: Pinyon-Juniper Fuelwood (MMBF)

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st decade	6	6	6	7	7	7	7	7
#4 Max PNV assigned	5	5	5	6	6	6	6	6
#5 NDY Eval.	6	6	6	6	6	6	6	6
#6 Max PNV market	4	4	4	4	4	4	4	4
#7 Low Budget	4	4	4	4	4	4	4	4
#8 Current Level	5	5	5	5	5	5	5	5
#9 Max Grazing capacity	15	15	15	15	15	15	15	15
#10 Alternative B (RPA)	10	10	10	10	10	10	10	10
#11 Alternative C (NCM)	8	8	8	8	8	8	8	8
#12 Alternative D (COM)	9	9	9	9	9	9	9	9
#13 Alternative E (MXB)	5	5	5	5	5	5	5	5
#14 Alternative PA (PREF)	9	9	9	9	9	9	9	9

Output: Water Yield (MAcFt)

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	302.7	301.9	303.1	309.4	309.7	305.3	313.2	303.6
#4 Max PNV assigned	302.5	302.3	307.5	307.6	309.2	303.3	311.0	304.0
5 NDY Eval.	302.7	306.4	321.2	221.9	319.9	307.1	316.4	305.7
#6 Max PNV market	302.2	302.0	305.6	306.4	311.7	302.2	308.8	303.1
#7 Low Budget	302.3	300.7	299.3	295.9	299.6	302.4	301.4	298.8
#8 Current Level	302.6	301.4	301.1	299.7	301.9	302.5	302.5	303.8
#9 Max Grazing capacity	302.6	310.9	316.9	318.7	321.4	305.4	324.6	304.7
#10 Alternative B (RPA)	302.5	302.6	302.9	301.0	304.0	307.4	302.9	307.0
#11 Alternative C (NCM)	302.6	300.3	298.5	295.2	298.5	300.7	299.0	297.2
#12 Alternative D (COM)	302.6	300.8	299.8	298.7	304.9	304.2	307.3	304.6
#13 Alternative E (MXB)	302.5	302.6	304.8	304.9	310.9	304.2	308.6	302.4
#14 Alternative PA (PREF)	302.5	300.8	299.8	298.9	302.6	302.4	300.0	301.1

Table 162 (continued). Average Annual Output by Benchmark and Planning Alternative

Output: Dispersed Recreation (MRVD)

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	278	316	352	386	422	422	422	422
#4 Max PNV assigned	266	302	336	369	402	402	402	402
#5 NDY Eval.	266	303	338	371	404	404	404	404
#6 Max PNV market	149	168	186	204	223	223	223	223
#7 Low Budget	202	231	257	282	308	308	308	308
#8 Current Level	255	285	317	348	379	379	379	379
#9 Max Grazing capacity	261	300	337	370	403	403	403	403
#10 Alternative B (RPA)	279	317	354	388	424	424	424	424
#11 Alternative C (NCM)	279	316	352	386	421	421	421	421
#12 Alternative D (COM)	256	287	319	349	380	380	380	380
#13 Alternative E (MXB)	254	290	323	355	386	286	286	286
#14 Alternative PA (PREF)	279	319	357	391	426	426	426	426

Output: Wildlife (MWFUD)

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	174.8	173.3	171.7	170.6	168.6	168.6	168.6	168.6
#4 Max PNV assigned	178.2	178.0	177.8	177.7	177.5	177.5	177.5	177.5
#5 NDY Eval.	175	177.5	180.0	182.4	184.8	184.8	184.8	184.8
#6 Max PNV market	173.9	174.9	175.9	176.9	178.0	178.0	178.0	178.0
#7 Low Budget	175.0	174.9	174.9	174.8	174.7	174.7	174.7	174.7
#8 Current Level	174.9	173.3	171.7	170.1	168.6	168.6	168.6	168.6
#9 Max Grazing capacity	175.0	176.8	178.5	180.2	181.9	181.9	181.9	181.9
#10 Alternative B (RPA)	174.0	174.8	175.6	176.4	177.2	177.2	177.2	177.2
#11 Alternative C (NCM)	190.0	185.4	180.9	176.4	171.8	171.8	171.8	171.8
#12 Alternative D (COM)	174.7	174.8	174.8	174.9	175.0	175.0	175.0	175.0
#13 Alternative E (MXB)	180.2	179.8	179.5	179.0	178.7	178.7	178.7	178.7
#14 Alternative PA (PREF)	180.9	179.4	177.9	176.4	174.9	174.9	174.9	174.9

Table 162 (continued). Average Annual Output by Benchmark and Planning Alternative

Output: Wilderness Recreation (MRVD)

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	4.7	5.3	5.8	6.4	6.8	6.8	6.8	6.8
#4 Max PNV assigned	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#5 NDY Eval.	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#6 Max PNV market	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#7 Low Budget	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#8 Current Level	3.7	4.1	4.6	5.0	5.5	5.5	5.5	5.5
#9 Max Grazing capacity	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#10 Alternative B (RPA)	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#11 Alternative C (NCM)	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#12 Alternative D (COM)	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#13 Alternative E (MXB)	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8
#14 Alternative PA (PREF)	7.4	8.3	9.2	10.1	10.8	10.8	10.8	10.8

Output: Developed Recreation (MRVD)

Benchmark	Period 1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	594.9	810.9	1019.5	1112.5	1114.7	1114.7	1114.7	1114.7
#4 Max PNV assigned	594.9	810.9	1019.5	1112.5	1114.7	1114.7	1114.7	1114.7
#5 NDY Eval.	594.9	810.9	1019.5	1112.4	1114.7	1114.7	1114.7	1114.7
#6 Max PNV market	594.9	810.9	1019.5	1112.5	1114.7	1114.7	1114.7	1114.7
#7 Low Budget	594.9	805.7	1016.0	1108.3	1110.0	1110.0	1110.0	1110.0
#8 Current Level	537.0	546.0	546.8	547.4	547.7	547.7	547.7	547.7
#9 Max Grazing capacity	594.9	810.9	1019.5	1112.5	1114.7	1114.7	1114.7	1114.7
#10 Alternative B (RPA)	594.9	810.9	1019.5	1112.5	1114.7	1114.7	1114.7	1114.7
#11 Alternative C (NCM)	584.9	701.7	787.2	801.3	1022.4	1022.4	1022.4	1022.4
#12 Alternative D (COM)	589.9	763.4	985.9	1012.7	1019.6	1019.6	1019.6	1019.6
#13 Alternative E (MXB)	594.9	810.3	1016.0	1108.3	1110.0	1110.0	1110.0	1110.0
#14 Alternative PA (PREF)	589.9	727.3	883.4	976.7	983.6	983.6	983.6	983.6

Table 162 (continued). Average Annual Output by Benchmark and Planning Alternative

Output: Permitted Grazing Use (MAUM)

Benchmark	Period							
	1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	78.1	73.4	75.6	75.6	75.6	75.6	75.6	75.6
#4 Max PNV assigned	77.4	71.9	73.0	72.5	72.3	72.3	72.3	72.3
#5 NDY Eval.	77.1	71.5	73.4	73.0	73.2	73.2	73.2	73.2
#6 Max PNV market	78.4	73.2	68.0	66.8	66.4	66.4	66.4	66.4
#7 Low Budget	72.2	68.1	64.3	62.8	62.0	62.0	62.0	62.0
#8 Current Level	78.0	72.9	74.9	74.7	74.5	74.5	74.5	74.5
#9 Max Grazing capacity	80.9	81.1	88.6	92.3	97.5	97.5	97.5	97.5
#10 Alternative B (RPA)	80.7	80.1	85.7	88.7	92.8	92.8	92.8	92.8
#11 Alternative C (NCM)	69.5	65.1	65.4	65.2	65.2	65.2	65.2	65.2
#12 Alternative D (COM)	76.7	77.1	83.6	86.8	91.2	91.2	91.2	91.2
#13 Alternative E (MXB)	76.1	71.2	68.7	67.6	67.2	67.2	67.2	67.2
#14 Alternative PA (PREF)	77.7	73.5	72.8	72.7	72.7	72.7	72.7	72.7

Output: Grazing Capacity (MAUM)

Benchmark	Period							
	1	2	3	4	5	10	15	20
#1 Min Level	0	0	0	0	0	0	0	0
#3 Max Timber 1st Decade	71.4	73.5	76.1	77.2	77.1	83.1	77.3	75.8
#4 Max PNV assigned	70.9	72.2	73.9	73.8	74.9	77.0	73.4	72.7
#5 NDY Eval.	70.9	72.5	75.0	77.0	79.5	78.8	74.4	73.8
#6 Max PNV market	69.8	69.5	68.9	67.5	68.9	71.6	67.3	67.3
#7 Low Budget	66.8	66.2	65.1	64.5	64.3	63.0	62.8	62.8
#8 Current Level	71.3	73.1	75.9	76.5	77.1	77.7	77.7	77.7
#9 Max Grazing capacity	74.7	81.4	93.4	103.5	112.1	104.0	106.7	105.4
#10 Alternative B (RPA)	73.9	78.7	88.5	94.3	111.9	98.3	98.4	96.4
#11 Alternative C (NCM)	62.7	64.2	66.1	66.8	67.1	68.7	66.7	65.2
#12 Alternative D (COM)	71.5	77.3	85.0	90.3	94.2	95.1	100.1	98.6
#13 Alternative E (MXB)	69.3	69.5	69.6	68.4	70.0	73.4	68.3	67.8
#14 Alternative PA (PREF)	70.0	71.6	73.6	74.0	74.9	75.6	74.1	73.6

Table 163. Comparison of Cumulative Economic Benefits, Costs and Present Net Value of Benchmarks and Planning Alternatives to Maximum PNV Assigned Benchmark (thousands of 1982 First Quarter Dollars).

Benchmarks	Total Benefits	Total Costs	Present Net Value	Percent of Max PNV Assigned
#1 Min Level	1098307	173965	852035	1.003
#3 Max Timber-1st Decade	1080600	651546	848838	1.000
#4 Max PNV-assigned	1177210	188077	909244	1.071
#5 NDY Eval.	1017361	193950	351212	0.414
#6 Max PNV-market	964435	129525	782338	0.922
#7 Low Budget	884996	146583	672110	0.792
#8 Current Level	1149467	207348	855646	1.008
#9 Max Grazing Capacity	1016654	159917	791435	0.932
#10 Alternative B (RPA)	941044	143703	738964	0.871
#11 Alternative C (NCM)	978898	158891	755345	0.889
#12 Alternative D (COM)	1063741	156016	842773	0.993
#13 Alternative E (MXB)	982053	152705	766807	0.903
#14 Alternative PA (PREF)				

The reasons for PNV variations around the Max PNV Assigned benchmark (BM4) are as follows:

1) BM4 is the standard, i.e. the most economic fashion to manage the Forest, given the legislative and political constraints placed on the managers.
2) BM5 displays a 7.1 percent increase of PNV over BM4. The increase is due to the release of the NDY constraint.
3) BM9 displays a .8 percent increase over the PNV of BM4, which again is attributed to the release of the NDY constraint.
4) BM3 displays a .3 percent increase over the standard attributable to the release of all MMR's.
5) All other benchmarks and planning alternatives display PNV's less than the standard. These differences are attributable to the variety of constraints and objectives of the particular planning problems modeled.

This table does not include wildlife WFUD'S benefits.

The section on Coefficients explains the difference between market and assigned values for priced outputs. Two benchmarks were developed to examine the significant effects, if any, that market versus assigned values have on output levels. The Max PNV Assigned Benchmark has all priced outputs with market and assigned values available in the objective function of the model. The Max PNV Market Benchmark has only market value outputs in the objective function. Table 164 displays a comparison of the two benchmarks.

It was expected that the PNV of the Max PNV Assigned Benchmark would be larger than the PNV of the Max PNV Market benchmark. The results of the solutions shown in Table 164 confirm this expectation. It was also expected that the market value outputs would occur at higher levels in the Max PNV Market Benchmark. This expectation comes from the assumption that achieving significant levels of assigned value outputs can only occur by trading off significant amounts of market value outputs. This assumption was not valid (Table 164). For every output, production is higher for the Assigned Value Benchmark. This is explained through the understanding that commodity production gives rise to many amenities provided by the Forest in a surplus situation. That is, the MAX PNV Market Benchmark did not produce higher levels of market outputs because of economic efficiency.

Table 164. Comparison of Average Annual Outputs Having Market Prices with Outputs Having Assigned Values for Max PNV Assigned and Max PNV Market Benchmarks

Outputs having Market Value	Units	Average Annual Outputs in Period 1	5	20
SAWTIMBER	MBF			
Max PNV Assgnd				
Max PNV Assgnd		112273	106756	109881
Mkt		109665	1058520	107449
Change		2608	906	2432
PRODUCTS	MBF			
Max PNV Assgnd		782	2665	5767
Max PNV Mkt		700	1785	176
Change		82	880	5591
ALL FUELWOOD	MBF			
Max PNV Assgnd		1948	2293	633
Max PNV Mkt		1400	1408	1258
Change		538	885	-625
DEVELOPED RECREATION	MRVD			
Max PNV Assgnd		594.9	1114.7	1114.7
Max PNV Mkt		594.9	1114.7	1114.7
Change		0	0	0
DISPERSED RECREATION	MRVD			
Max PNV Assgnd		266	402	402
Max PNV Mkt		149	223	223
Change		117	179	179
WILDERNESS RECREATION	MRVD			
Max PNV Assgnd		7.4	10.8	10.8
Max PNV Mkt		7.4	10.8	10.8
Change		0	0	0
WILDLIFE RECREATION	MWFUD			
Max PNV Assgnd		178.2	177.5	177.5
Max PNV Mkt		173.9	178.0	178.0
Change		4.3	-.5	-.5
PERMITTED USE	MAUM			
Max PNV Assgnd		77.4	72.3	72.3
Max PNV Mkt		78.4	66.4	66.4
Change		-1	5.9	5.9
WATER YIELD	MAC-FT			
Max PNV Assgnd		302.5	307.2	304.0
Max PNV Mkt		302.3	299.6	298.8
Change		0.2	7.6	5.2

The following table displays the acreage by benchmark and planning alternative allocated to each emphasis level as described above. Any discrepancy in area is due to rounding errors.

Table 165. Acreage Allocation by Management Emphasis for Selected Benchmarks in 1000 Acres.

Management Emphasis*	Benchmark											
	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	ALTB	ALTC	ALTD	ALTE
A	2.2	2.2	2.2	2.2	2.2	2.2	0	2.2	2.2	2.2	2.2	2.2
B	0	103.9	907.9	810.4	43.2	80.8	0	50.1	263.7	750.2	0	459.1
C	0	108.6	0	0	10.2	0	1534.4	0	0	0	0	0
D	145.9	0.2	0.2	0.2	0.2	0.2	0	0.2	0.2	0.6	183.9	0.1
E	149.3	0	136.4	168.8	0	256.4	0	0	88.3	0	0	269.0
F	0.7	0.3	0.3	0.3	583.3	151.9	0	0.3	0.3	0.8	0.8	0.4
G	0	0.1	0.1	0.1	89.9	0.1	0	506.9	0.1	0	362.1	0.1
H	0	129.8	74.0	165.0	0	0	0	564.4	251.9	0	0	49.1
J	0	0	0	0	0	0	0	0	0	0	0	0
K	414.9	0	0	0	0	0	0	0	0	0	0	0
L	0	49.4	267.6	268.9	662.6	837.3	0	1.2	6.5	0	0.1	444.1
M	0	0	1.3	3.1	27.8	90.5	0	22.5	22.5	227.9	0	31.8
N	0	0	0	0	0	0	244.4	751.2	0	637.1	0	0
P	264.5	198.6	29.1	0	0	0	0	27.1	32.4	131.8	0	0
Q	115.1	6.5	115.1	115.1	115.1	115.1	0	115.1	115.1	0	115.1	115.1
R	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0	0	0	115.1	0
T	0	0	0	0	0	0	0	0	0	0	134.8	0
U	175.0	0	0	0	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0	0	97.8	0	0
W	47.5	0	0	0	0	0	0	0	0	21.2	98.4	0
X	219.2	0.2	0.2	0.2	0	0	0	0	0	186.4	0	163.4

* Codes for management emphases are defined in table 150.

FORMULATION OF ALTERNATIVES

Introduction

An alternative is a feasible management option that attempts to satisfy management goals. Different alternatives are generated by varying the type or emphasis of goals. Each alternative represents a different planning problem, or set of objectives, outputs, or constraints that respond to different viewpoints to satisfy identified issues.

The stages of the planning process preceding the formulation of alternatives that were combined and analyzed to provide the basis for alternatives include: identification of issues, development of criteria, data inventory and collection, and analyzing supply, projected future use, and production capabilities—the analysis of the management situation (AMS).

The AMS benchmark analyses explore a "reasonable range" of production possibilities within the parameters of supply, expected future use, and production capabilities.

The benchmark analyses provide the decision space within which integrated alternatives are formulated. An integrated alternative is one in which individual resource objectives are compatible with the minimum legal and resource integration requirements of 36 CFR 219.13 through 219.27.

The "formulation of alternatives" step examines a set of alternatives that reflect the complementary and competetive relationships among the goods, services, and uses produced by the Forest.

The National Forest Management Act (NFMA) implementing regulations [36 CFR 219.12[f]] specify guidelines and criteria that determine the reasonable range of alternatives. These are:

Alternatives shall be distributed between the minimum resource potential and the maximum resource potential to reflect, to the extent practicable, the full range

of major commodity and environmental resource uses and values that could be produced from the Forest. Alternatives shall reflect a range of resource outputs and expenditure levels.

Alternatives shall be formulated to facilitate analysis of opportunity costs and the resource use and environmental trade-offs among alternatives and between benchmarks and alternatives.

Alternatives shall be formulated to facilitate evaluation of the effects on present net value, benefits, and costs of achieving various outputs and values that are not assigned monetary values, but that are provided at specified levels.

Alternatives shall provide different ways to address and respond to the major issues identified during the planning process.

Reasonable alternatives that may require a change in existing law or policy to implement shall be formulated, if necessary, to address a major issue identified during the planning process [40 CFR 1501.7, 1502.14(c)].

At least one alternative shall be developed that responds to and incorporates the RPA Program tentative resource objectives for each Forest displayed in the regional guide.

At least one alternative shall reflect the current level of goods and services provided by the unit and the most likely amount of goods and services expected to be provided in the future if current management direction continues. Pursuant to NEPA procedures, this alternative shall be (referred to as) the "no action" alternative.

Each alternative shall represent, to the extent practicable, the most cost efficient combination of management prescriptions examined that can meet the objectives established in the alternative.

Each alternative shall state at least: The condition and uses that will result from long-term application of the alternative, the goods and services to be produced, the timing and flow of these resource outputs together with associated costs and benefits, resource management standards and guidelines, and the purposes of the management direction proposed.

The Chief's policy letter of October 4, 1981, and FSM 1920.85—1 through 85—3 provides direction for formulating the following types of alternatives in addition to those specified in the NFMA regulations:

1. An alternative that emphasizes market opportunities.

   Emphasis for the alternative is on timber, range, minerals, developed recreation, and other outputs that have the potential to produce income to the government. Management for other resources will be at economically and environmentally feasible levels consistent with the emphasis on market-oriented outputs.

2. An alternative that emphasizes non-market opportunities.

   The emphasis is on water, fish and wildlife, dispersed recreation, and other amenity values. Management for other resources will be at economically and environmentally feasible levels consistent with the emphasis on amenity values.

Specific requirements to be addressed in the alternative formulation process are presented in FSM 1920.85—4 through 85—5, Supplement No. E.

Alternative Feasibility

Forest Service Manual 1920.85, R-3 Supplement No. E specifies the range of reasonable alternatives which should be within the limits established by:

1. Technical feasibility—the inherent capability of the lands and resources as modified by varying levels of management and within the limits of existing or anticipated technology.

2. Economic and financial feasibility—the amount of funds expected to be available to conduct proposed and probable activities.

3. Legal feasibility—within the limits established by law, regulation, executive order, or service-wide or regional policy.

Alternative Formulation Process

Kaibab planning alternatives C, D, and the preferred alternative are tied directly to resolution of the ICO's developed in the initial scoping process. A complete description of the ICO's is found in Appendix A. The process involved examination of each of the initial 85 allocation zones delineated early in the planning process. District rangers and their principal resource staff assistants examined every allocation zone and ranked three ICO's [of thirteen] most in need of resolution in that allocation zone. In addition, the rangers and their staff recommended an allocation choice [management emphasis] that best resolved the three ICO's identified for resolution in each allocation zone.

Oftentimes, the set of three ICO's and the recommended allocation choice were identical for several contiguous allocation zones. This fact permitted the aggregation of these smaller allocation zones, with the same set of issues and consequently allocation choices, into larger allocation zones. This aggregation of smaller allocation zones into larger zones resulted in a much more efficient model, reduced computer and operational costs, and did not reduce our ability to analyze problems nor resolve issues. Maps of these allocation zones are in the process record in the Supervisor's Office.

The Forest interdisciplinary team reviewed the recommendations of the district rangers for each allocation zone. The ID team developed planning alternative D, commodity or market orientation, by selecting allocation choices, that emphasized the resolution of the commodity side or facet of the three ICO's identified by the district rangers. In the case of planning alternative C, non-market or ammenity orientation, the Forest ID team emphasized resolution of the non-commodity side or facet of the ICO's identified by the district rangers. The Forest ID team attempted to maximize resolution of three ICO's identified by the district rangers in the preferred alternative. In all alternatives developed using the coordinated allocation approach, the Forest ID team provided additional allocation choices that are compatible with the allocation choice recommended by the district ranger. All choices were allowed in alternatives B and E, since these alternatives were driven primarily by economic efficiency.

Description of Alternatives

Alternatives considered in detail in the EIS are described below. Note that outputs and effects fall within the benchmark "decision space". Each alternative, or problem involved a budget constraint of $8.1 million annually. The budget constraint was needed to ensure that reasonably expected budgets were not exceeded and to be in concert with national priorities of control of government spending. Each alternative shared a common objective of maximizing PNV for all assigned values. Fuelwood production is not given any economic value in the model after a specified amount, the FORPLAN method of modeling demand curves. The fuelwood cut-offs used in the planning problems studied in detail are as follows:

Table 166. Fuelwood Cut-offs

District	Volume
Williams/Chalender	5159 MBF
Tusayan	539 MBF
North Kaibab	2002 MBF

The following constraints were common to each planning problem.

Table 167, Constraints Common to Each Planning Problem

MMR's
CMAI
NDY
LRSY
EI

In the following descriptions of alternatives, the choices listed for each zone indicate the coordinated allocation choices that were available for selection for that zone. Prescription controls define the management emphasis and intensity that could be applied to each developed recreation site.
See Table 160 for description of purpose and rationale of constraints.

The following describes each planning problem studied in detail, with 'additional' constraints. See Table 162 for planning alternative inputs.

PROPOSED ACTION PA:

This alternatve best resolves all ICO's, within the expected budget constraint or allocation.

Objective Function: PNV

Budget Constraint:

Description	Decades 1 & 2	Annual $
		8,100,000

Allocation Choices [defined in table 150]:

ZONE	CHOICES
W1	K U V
W2	J P
W3	J T
W4	Q
W5	K U V X
W6	K U V X
W7	K U V
W8	K U V
W9	J P T
W10	J P T
W11	J P T
W12	H P
W13	J P T
TB	K U V
TC	K U V X
TD	E J U V
TE	E J P X
N1	U V W X
N2	K U V
N3	R W X
N4	E J P
N5	E H R
N6	D J P
N7	D J P
N8	D J P
N9	Q
N10	Q

Prescription Controls:

ANALYSIS AREA	MANAGEMENT EMPHASIS	MANAGEMENT INTENSITY
34	D	
35	D	
36	D	
37	D	
38	F	
39	F	
40	D	

41	A	Z4
107	A	Z3
67	D	
68	D	Z1/Z2
69	A	Z1
98	D	
99	D	Z1
100	I	
101	I	
102	D	Z1
103	A	Z3
104	A	Z2
105	D	
106	A	Z5

Extended Rotations for Old-growth Habitat:
Old-growth constraints were defined as a minimum percent of the tentatively suitable timberlands, as follows:

North Kaibab 9%
South Kaibab 9%

The 9% value for the Kaibab was the optimal value established by the ID team.

Timber Production:
Timber harvest constraints in the first decade was established as follows:

	ceiling
North Kaibab	61MMBF
South Kaibab	12MMBF

This was primarily due to the inability of the industry and the Forest Service to absorb a one decade jump in harvest levels. The ceiling also smoothed out the sequence of harvest levels from one decade to the next.

Grazing Use:
Annual grazing capacity constraints were established in the first decade. The rationale for this constraint is to maintain a practical level of capacity.

Floor	Ceiling
80000 AUM/yr	76610 AUM/yr

ALTERNATIVE A: CURRENT-NO CHANGE

This problem represents the no action alternative. It is constrained by current management intensities.

Objective Function: PNV

Budget Constraint:

Description	Decades	Annual $
	1 & 2	7,300,000

Allocation Choices [defined in table 150]:

ZONE	CHOICES
All zones were given only current direction choices	

Prescription Controls:
All developed recreation sited forced to current management intensities.

Old-growth:
A floor on old-growth was established by the Forest ID team which represented the MMR for wildlife concerns, and is applied to this alternative as follows:

North side 3%
South side 3%

Timber Production:
Timber harvest in the first decade was constrained to be within the limits of the current timber management plan, as follows:

	Floor	Ceiling
North side		51.7MMBF
Forest-wide		62.4MMBF

Alt B RPA Program

This problem models the RPA program as defined by the R3 regional office.

Objective Function: PNV

Budget Constraint:

Description	Decades	Annual $
	1 & 2	8,100,000

Allocation Choices [defined in table 150]:

ZONE CHOICES

All choices offered to all zones

Prescription Controls:

ANALYSIS AREA	MANAGEMENT EMPHASIS	MANAGEMENT INTENSITY

No prescription controls for developed recreation sites.

Old-growth:

Old-growth requirements are the same as the "current alternative":

North side	3%
South side	3%

Other:

Constraints needed to meet RPA targets follow:

OUTPUT or ACTIVITY	PERIOD	MINIMUM QUANTITY	UNIT
Habitat Improvement	1	1230 / year	ACRE
	5	2800 / year	
Grazing Capacity	1	73900 / period	AUM
	5	112000 / period	
Net Merchantible Timber	1	7230 / period	MMcf
Water Yield	1	2295000 / period	AC-FT
	5	2460000 / period	

Alt C

The solution to this problem addressed non-market or amenity values, the solution is feasible and practicable.

Objective Function: PNV

Budget Constraint:

Description	Decade	Annual $
	1	8,100,000

Allocation Choices [defined in table 150]:

ZONE	CHOICES
W1	K U V
W2	K U V
W3	J M P T
W4	S
W5	K R W X
W6	K R W X
W7	K R W X
W8	K R W X
W9	J M P T
W1	J M P T
W1	J M P T
W1	K U V
W1	J M P T
TB	R W X
TC	R W X
TD	R W X
TE	J T
N1	W
N2	K R X
N3	R W
N4	J M P T

N5	M P T
N6	J M P T
N7	J M P T
N8	J M P T
N9	S
N10	S

Prescription Controls:

ANALYSIS AREA	MANAGEMENT EMPHASIS	MANAGEMENT INTENSITY
34	D	
35	D	
36	D	
37	G	Z2
38	F	
39	F	
40	D	
41	A	Z3
107	A	Z4
67	L	
68	D	Z1/Z2
69	A	Z1
98	L	
99	D	Z1
100	L	
101	D	
102	D	Z1
103	A	Z3
104	A	Z2
105	D	
106	A	Z5

Old-growth:
The Forest ID team established the following percent of tentatively suitable timberland acres to extended rotation (old-growth) as a wildlife objective:
Forest-wide 15%

Timber Production:
In order to reduce the emphasis on timber production in the density alternative, a ceiling on timber harvest was established as follows:

	Floor	Ceiling
North side		52MMbf
South side		14MMbf

Alt D

The solution to this problem addressed the commodity production concern of the public.

Objective Function: PNV

Budget Constraint:

Description	Decade	Annual $
	1	8,100,000

Allocation Choices (defined in table 150):

ZONE	CHOICES
W1	N T
W2	D G
W3	D G
W4	Q
W5	D T
W6	D T
W7	D T
W8	D T
W9	D G
W10	D G
W11	D G
W12	D G
W13	D G
TB	N T

TC	N T
TD	N T
TE	D G
N1	W
N2	N T
N3	D G
N4	D G
N5	H P R
N6	D G
N7	D G
N8	D G
N9	Q
N10	Q

Prescription Controls:

ANALYSIS AREA	MANAGEMENT EMPHASIS	MANAGEMENT INTENSITY
34	D	
35	D	
36	D	
37	G	Z1
38	F	
39	F	
40	F	
41	A	Z5
107	A	Z5
67	D	Z2
68	D	Z1/Z2
69	A	Z5
98	D	
99	D	Z1
100	D	
101	F	
102	D	Z1
103	A	Z5
104	A	Z5
105	F	
106	A	Z5

Old-growth:
All Forest 9%

Range Production:
The range capacity constraint is imposed to force an increased use of the range resource.

Timber Production:
A ceiling on the maximum amount of timber harvest that the industry could absorb in the first decade was established as follows:

	Floor	Ceiling
North side		75MMbf

Alt E

The solution to this problem provided the most economic way to manage the Forest given a budget constraint, but regardless of ICO's.

Objective Function: PNV

Budget Constraint:

Description	Decade	Annual $
	1/2	8,100,000

Allocation Choices (defined in table 150):
All allocation choices are available.

Prescription Controls:
There are no constraints on recreation site construction options.

Other:
None.

SOCIAL AND ECONOMIC IMPACT ANALYSIS

Social Overview

Social impact analysis is defined in FSM 1978 as "the determination of how Forest Service policies and action affect the quality of people's lives or social well-being. The primary goal is to enable managers to take into account important social concerns in making decisions. Social analysis is accomplished by comparing current social conditions in an area influenced by Forest Service action with conditions likely to occur as a result of implementing management alternatives."

The objectives of social impact assessment are to:

Determine in a systematic manner the social effects of Forest Service planning and decision making.

Provide the decision maker with an assessment of social effects which can be considered along with the assessments of economic, physical, and biological effects in order to make a balanced decision which promotes the goal of attaining "productive and enjoyable harmony between man and his environment."

Satisfy the requirements of the law [NEPA, NFMA, CEQ] and of Forest Service policy [FSM 1973].

The following steps are used in the social analysis:

Delineate geographic zones of influence that will be used to assess the effects of National Forest management on social variables. The first zone is the primary zone which is made up of the multi-county area (used by IMPLAN) and the sub-areas: a breakdown of local areas having a strong dependence on the National Forest. The secondary zone of influence comes from outside the primary zone, consisting of nonlocal and generally amenity uses. The third zone is the Native American and consists of Indian tribes or groups using the Forest.

Each social variables affected by National Forest management are evaluated for each alternative. Alternatives are measured against the current situation baseline for each variable. The variables are: employment; income; population; community lifestyles; social organization; relationship to minority groups; land use patterns; and attitude, beliefs, values.

Economic Overview

The IMPLAN model is used to respond to the 36 CFR 219 planning requirements for economic impact analysis. It has been designed to provide the planning analyst with the capability to construct a regional input-output (I/O) model for any applicable area and perform evaluations of potential economic effects in support of the planning process.

Some of the outputs for each alternative (FORPLAN results) are entered into the IMPLAN model. The resulting figures for employment, income, and population are evaluated against the current situation baseline for effects on the subareas.

The inputs and units of measure taken from the FORPLAN model follow.

Table 168. Inputs and Units of Measure Used by I/O Model

Timber, sawtimber (MMBF)
Timber, products (MMBF)
Fuelwood, personal-use (MMBF)
Picnicking (MRVD)
Camping (MRVD)
Recreation skiing-resident (MRVD)
Recreation skiing-nonresident (MRVD)
Recreation-water activities (MRVD)
Dispersed non-motorized recreation (MRVD)
Dispersed motorized recreation (MRVD)
Dispersed recreation, snowmobiles (MRVD)
Hunting, big game (MRVD)
Hunting, small game (MRVD)
Hunting, birds and waterfowl (MRVD)
Wildlife (MRVD)
Fishing (MRVD)
Livestock, cattle (MAUM)
Livestock, sheep (MAUM)
Government expenditures, employee compensation (MM$)
Government expenditures, O&M and investment (MM$)

The outputs are changes in employment and income (Forest Service generated) by economic sector. Several sectors are impacted by the Forest Service program, most of them only to a small extent. The sectors impacted most significantly are timber, wholesale and retail, trade, eating and drinking services, hotels, recreation, and credit agencies.

EFFECTS OF BENCHMARKS, CONSTRAINTS AND ALTERNATIVES

The effects of the benchmarks, discretionary constraints, and alternatives are displayed in Chapters 2 and 4 and Appendixes B and E of the EIS, and the analysis of the management situation (AMS). The analysis of tradeoffs among alternatives is contained in Chapters 2 and 4 of the EIS. The analysis of constraints within alternatives is described elsewhere in Appendix B.

Appendix C – List of Technical Reports

1. The Development and Formulation of Public Issues, Management Concerns, and Resource Use and Development Opportunities.
2. The Compilation and Management of Resource Inventory Information in the Land and Resource Planning Process.
3. The Definition and Application of Analysis Areas, Allocation Zones, and Managemenmt Areas in the Land and Resource Planning Process.
4. The Identification of Minimum Resource Management Requirements in the Land and Resource Management Planning Process.
5. The Range Process for Developing Range Production and Cost Coefficients for use in the FOPRPLAN Model, May 30, 1984.
6. Economic Efficiency Analysis in Forest Planning for Engineering Functional Support.
7. Technical Report for the Timber Resource.
8. Technical Report for the Recreation Resource.
9. Technical Report for Mineral Resources.
10. Technical Report for Wildlife and Fish Resources.
11. Technical Report for Soil and Water Resources.
12. Technical Report for Fire and Fuel Management.

Index

Adverse Environmental Effects 65
Air Quality 65, 103, 154, 163
Allocation Zones 224
Allowable Sale Quantity 21, 31, 139
Alternatives 214
Alternatives: Benchmarks 17
Alternatives: Comparison of 30
Alternatives: Considered in Detail 19
Alternatives: Eliminated From Detailed Study 17
Alternatives: No Action 22
Analysis Areas 14, 215
Analysis of the Management Situation (AMS) 3, 17, 214
Assigned Values 15
Availability of Land 47
Beale Wagon Trail 4
Benchmarks 214
Benefit Values 231
Benefits 15, 54, 58
Budget 50, 248-252
Campgrounds 70, 112
Camping 71
Capacity (Grazing) 33, 91, 134
Climate 1
Constraints 247-248
Coordination of Planning 3
Corridors: Utility 87, 134
Costs 15, 50, 232
Council on Environmental Quality (CEQ) 1
Counties: Payments to 56
Criteria for Evaluation 7
Cultural Resources 6, 42, 65, 77, 122, 161, 162
Demand Trends 71, 74-77, 85, 91, 95, 100-104
Departure 18
Discounted Benefits 16
Diversity 30, 40, 76, 78, 122, 125
Economic Efficiency 16, 158, 233
Ecosystems 78
Employment 159
Employment & Income 69
Energy Efficiency 157
Environmental Assessments 2
Environmental Impact Statement (EIS) 1
Environmental Protection Agency 1
Facilities 106, 154, 156
Fire 103, 152
Firewood 5, 95, 144
Floodplains 98
Forest & Range Renewable Resources Planning Act (RPA) 1
Forest Products (other than Timber) 31, 64, 93
FORPLAN 16, 214-215
Fuelwood 5, 95, 144
Game Preserve 84
Geology 67
Grand Canyon National Game Preserve 4, 84
Grazing 5, 33, 90, 134
IMPLAN 159
Indian Reservations 3
Indian Tribes 213
Insect & Disease 4, 31, 65, 96, 153
Integrated Pest Management (IPM) 97, 153
Issues 4
Kanab Creek Wilderness 4
Knutsen-Vandenburg Act (K-V) 126
Land 65, 85, 131, 161, 162
Land: Acquisition 85, 131
Land: Base-in-Exchange 85
Land: Survey 90, 134
Lands Suited for Timber Harvest 92
Lands: Suitable for Timber Production 31, 92, 137
Long-term Sustained-yield Capacity (LTSYC) 21, 30, 138
Maintenance: Facilities 106, 115
Maintenance: Roads & Trails 50, 104,
Market Value 58
Minerals 65, 100, 161, 163
Minerals: Exploration & Development 102
Minerals: Leaseable/Locatable 100
Minerals: Management 7, 100, 149
Minerals: Withdrawals 7, 89, 149
Minimum Management Requirements 19, 227
National & Regional Planning 2
National Environmental Policy Act (NEPA) 1
National Forest Management Act (NFMA) 1
National Register of Historic Places 6, 42, 77
Net Public Benefits 16
Non-market Goods & Services 58
Notice of Intent 1
Objectives 1
Off-road Vehicles 38, 72, 114
Oil & Gas 100
Old-growth Habitat 80, 125, 128, 143
Outputs 48, 229
Planning Area 4
Planning Horizon 2
Planning Process 3, 215
Planning Records 3
Planning Regulations 9
Population 68
Prescriptions 15, 221
Present Net Values 16, 58, 158, 243
Process Records 237
Proposed Action 1
Range 5, 64, 161
Reader's Guide 8
Receipts 58
Receipts: Returns to Federal Government 56
Receipts: Returns to Local Governments 56
Record of Decision 1
Recreation 37, 108
Recreation Opportunity Spectrum 37, 73, 115
Recreation: Camping 36, 70, 71
Recreation: Developed Use 5, 35, 36, 63, 65, 70, 108, 160, 162
Recreation: Dispersed Use 5, 37, 63, 65, 71, 114, 160, 162
Recreation: Hiking 36, 71
Recreation: Off-road Vehicle Use 5, 38, 72, 114
Recreation: Skiing, Downhill 5, 37, 71, 110
Recreation: Skiing, Cross-country 5, 71, 114
Reforestation 94, 140
Research Natural Area 6, 43, 90, 134
Reservations 88
Resource Trade-off's 60
Rights-of-Way 86-87, 133
Riparian Areas 64, 83, 131, 161
Roads 6, 38, 50, 104, 130
Saddle Mountain Wilderness 4
Social & Economic Setting 68
Social Effects 160
Social Situation 253

Special Uses 85, 133
Threatened & Endangered Species 81, 129
Timber 4, 31, 64, 65, 92, 137, 161, 162
Timber: Harvest Suitability 31, 92, 137
Timber: Sale & Yield 31, 94
Timber: Slash 95
Timber: Thinning 94, 141
Trails 72,75
Transportation System 6, 104, 154
Uneven-aged Management 19
Vegetation 67, 128
Visual Quality/Resource 64, 65, 76, 121, 160, 162
Water 97
Water: Municipal 99
Water: Quality 98
Water: Reservoirs & Dams 98
Water: Rights 100
Water: Supply 98
Water: Turbidity 98
Water: Yield 98
Watershed 5, 21, 34, 64, 161
Watershed: Condition 21, 34, 99
Watershed: Improvement 21, 34
Watershed: Soil Loss 21, 34, 148
Wild Horse & Burro 91
Wilderness 6, 42,63-65, 74-75, 114, 119, 161, 162
Wilderness & Special Areas 6
Wilderness Areas 4
Wildlife 40, 65, 77, 124, 161, 162
Wildlife: Habitat 6, 40, 77, 124, 125
Wildlife: Management Indicator Species 40, 80, 127
Wildlife: Recreation 129

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